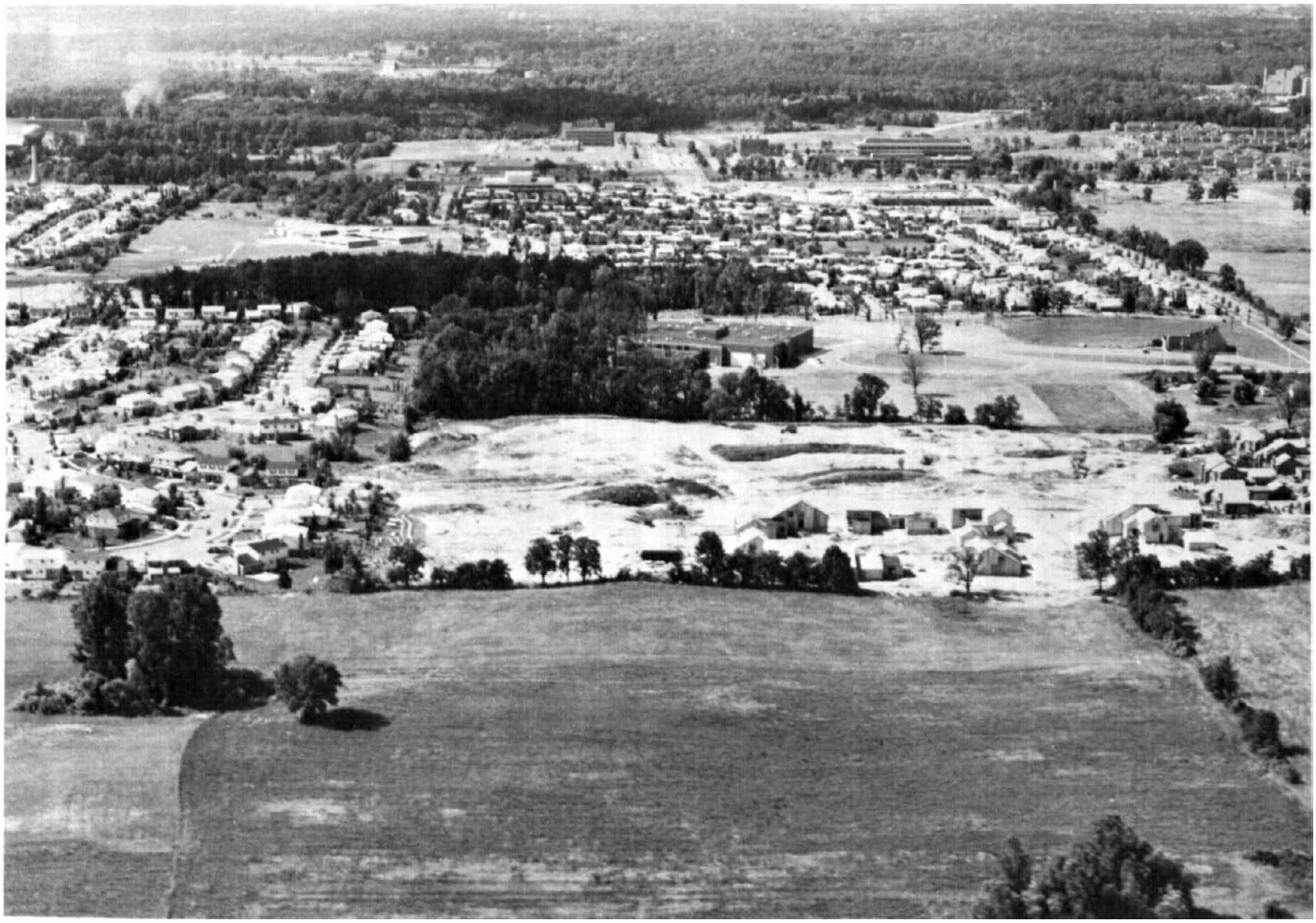
SOIL SURVEY OF

Washtenaw County, Michigan



United States Department of Agriculture
Soil Conservation Service
in cooperation with
Michigan Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1968–73. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service and the Michigan Agricultural Experiment Station. It is part of the technical assistance furnished to the Washtenaw County Soil Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodland; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Washtenaw County are shown on the detailed map at the back of this survey. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetical order by map symbol and gives the capability classification and woodland suitability classification of each. It also shows the page where each soil is described and the page for the capability unit.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same degree of limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and woodland groups.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife habitat in the section "Wildlife."

Engineers, community planners, and builders can find, under the heading "Engineering," tables that contain test data, estimates of soil properties, and interpretations of these soil properties as they affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers to the county may be especially interested in the section "General Soil Map," where broad patterns of soils are described, and in the general information about the county given at the beginning and end of the publication.

Cover Picture: Typical landscape of Boyer-Fox-Sebewa soil association near Saline.

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United States Department of Agriculture, Soil Conservation Service, in cooperation with the Michigan Agricultural Experiment Station

WASHTENAW COUNTY is in the southeastern part of the lower peninsula of Michigan (fig. 1). The city of Ann Arbor is the county seat. The cities of Ann Arbor and Ypsilanti are the main commercial, industrial, and educational centers of the county. The total area of Washtenaw County is about 458,000 acres, or about 716 square miles.

The climate is favorable for most crops, and farming is still a very important industry in Washtenaw County. About 43 percent of the county is in crops. The major crops are corn, wheat, oats, soybeans, and grass-legume hay.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Washtenaw County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and nature of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

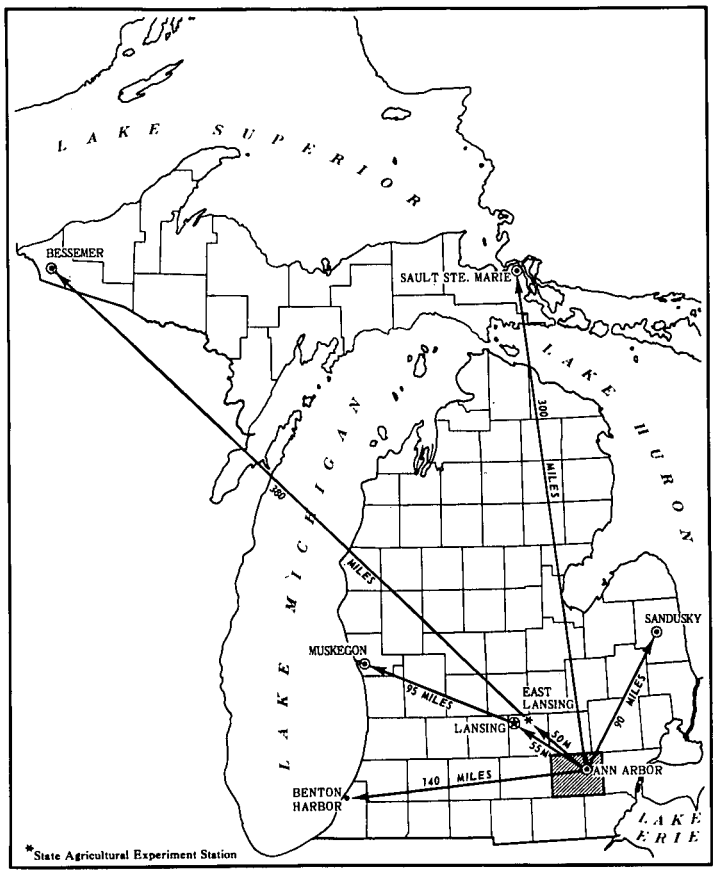

Figure 1.—Location of Washtenaw County in Michigan.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures (*5*).[1] The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. For example, Morley and Fox are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristics that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Boyer loamy sand, 0 to 6 percent slopes, is one of several phases within the Boyer series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show

[1] Italic numbers in parentheses refer to Literature Cited, p. 106.

on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map at the scale of mapping used. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Boyer-Kidder complex is an example.

In most areas surveyed there are places where the soil material is so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Made land is a land type in this survey.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurement and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how the soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Washtenaw County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

More detailed information about the soils is given in the section "Descriptions of the Soils."

Nearly Level to Very Steep, Well Drained Soils that are Underlain by Coarse Textured and Moderately Coarse Textured Material and Nearly Level, Very Poorly Drained Organic Soils

In many areas these soils have slight limitations for urban use. Except on the organic soils, slope is the major limitation. The organic soils have severe limitations for most urban use because they are wet and have low strength.

1. Boyer-Spinks-Houghton association

Nearly level to very steep, well drained soils that have a moderately coarse textured or coarse textured subsoil and coarse textured underlying material and nearly level, very poorly drained organic soils; in outwash areas

This soil association consists of well drained soils that formed in stratified sediments and very poorly drained soil that formed in organic deposits. The soils are mostly sloping to steep. Slopes are complex. Most areas of steep and very steep soils are near areas of organic soils.

This soil association makes up about 9 percent of the county. It is about 22 percent Boyer soils, 19 percent Spinks soils, 15 percent Houghton soils, and 44 percent soils of minor extent. The well drained Boyer and Spinks soils are in high areas and on ridges and hills. The very poorly drained Houghton soils are in depressional areas, along streams, and at the edges of lakes.

Boyer soils are nearly level to very steep and are well drained. The surface layer typically is dark grayish-brown loamy sand 8 inches thick. The subsurface layer is 10 inches of yellowish-brown loamy sand. The subsoil is 14 inches thick. The upper part is strong-brown, friable sandy loam, and the lower part is brown, firm heavy sandy loam. The underlying material is pale-brown gravelly coarse sand.

Spinks soils are nearly level to steep and are well drained. The surface layer typically is dark grayish-brown loamy sand 10 inches thick. The subsoil is 75 inches thick. The upper part is yellowish-brown, very friable loamy sand. The lower part is pale-brown, loose fine sand and bands of dark-brown, friable loamy fine sand. The underlying material is yellowish-brown fine sand.

Houghton soils are nearly level and very poorly drained. The surface layer typically is very dark brown muck 7 inches thick. Below this is 15 inches of black muck and 28 inches of very dark brown muck. The lower layer is dark brown and very dark brown muck.

The more extensive minor soils in this association are the Edwards, Fox, and Oshtemo soils. Edwards soils are in areas similar to those of the Houghton soils. Fox and Oshtemo soils are closely intermingled with Boyer and Spinks soils.

Most of this association is used for woodland, recreation, wildlife, and crops. The moderately steep to very steep soils and the organic soils are used mostly for woodland, recreation, or wildlife. Most of the cropped acreage is nearly level to sloping. Corn, small grain, and hay are the crops commonly grown.

The available water capacity of the well drained soils is low. Where they are cultivated, the chief concerns of management are controlling erosion and maintaining soil moisture. The very poorly drained organic soils are too wet for crop production unless they are artificially drained.

2. *Boyer-Kidder-Houghton association*

Nearly level to very steep, well drained soils that have a moderately coarse textured or moderately fine textured subsoil and coarse textured or moderately coarse textured underlying material and nearly level, very poorly drained organic soils; on moraines

This soil association consists of well drained soils that formed in sandy loam, glacial till, and stratified loamy sand and gravelly sand deposits and very poorly drained soils that formed in organic deposits. The soils are mostly gently sloping to steep. Slopes are convex. Most of the steepest soils are near areas of nearly level organic soils.

This soil association makes up about 5 percent of the county. It is about 24 percent Boyer soils, 17 percent Kidder soils, 7 percent Houghton soils, and 52 percent soils of minor extent. The well drained Boyer and Kidder soils are in high areas and on ridges and hills. The very poorly drained Houghton soils are in depressional areas and along streams.

Boyer soils are nearly level to very steep and are well drained. The surface layer typically is dark grayish-brown loamy sand 8 inches thick. The subsurface layer is 10 inches of yellowish-brown loamy sand. The subsoil is 14 inches thick. The upper part is strong-brown, friable sandy loam, and the lower part is brown, firm heavy sandy loam. The underlying material is pale-brown gravelly coarse sand.

Kidder soils are gently sloping to very steep and are well drained. The surface layer typically is dark grayish-brown sandy loam 8 inches thick. The subsurface layer is 5 inches of pale-brown sandy loam. The subsoil is 23 inches thick. The upper part is brown, friable sandy clay loam, and the lower part is yellowish-brown, firm clay loam. The underlying material is pale-brown sandy loam.

Houghton soils are nearly level and are very poorly drained. The surface layer typically is very dark brown muck 7 inches thick. Below this is 15 inches of black muck and 28 inches of very dark brown muck. The lower layer is dark-brown and very dark brown muck.

The more extensive minor soils in this association are the Fox, Spinks, and Miami soils. These minor soils are in positions similar to those of the Boyer and Kidder soils.

Most of the well drained, gently sloping to moderately steep soils of this association are used for crops (fig. 2), mainly small grain, hay, and corn. Most of the steep and very steep, well drained soils are used for pasture, woodland, and recreation. Most of the very poorly drained, nearly level, organic soils are used for wildlife, woodland, and recreation. One large area is drained and used for specialty crops.

The available water capacity of the well drained soils is low or moderate. In cultivated areas the chief concerns of management are controlling erosion and maintaining available water. The very poorly drained organic soils are too wet for crop production unless artificially drained.

Nearly Level to Steep, Well Drained to Very Poorly Drained Soils that are Underlain by Coarse Textured Material

In many areas these soils have slight limitations for most urban use. Some have severe limitations because they are wet or steep.

3. *Boyer-Fox-Sebewa association*

Nearly level to steep, well drained and very poorly drained soils that have a moderately coarse textured to moderately fine textured subsoil and coarse textured underlying material; on outwash plains, valley trains, terraces, and moraines

This soil association consists of well drained and poorly drained soils that formed in moderately coarse textured and moderately fine textured stratified sediments. The soils are mostly nearly level to sloping. Slopes are complex.

This soil association makes up about 14 percent of the county. It is about 24 percent Boyer soils, 24 percent Fox soils, 12 percent Sebewa soils, and 40 percent soils of minor extent. The well drained Boyer and Fox soils are in the higher areas. The poorly drained and very poorly drained Sebewa soils are in lower areas and depressional areas.

Boyer soils are nearly level to steep and are well drained. The surface layer typically is dark grayish-brown loamy sand 8 inches thick. The subsurface layer is 10 inches of yellowish-brown loamy sand. The subsoil is 14 inches thick. The upper part is strong brown, friable sandy loam. The lower part is brown, firm heavy sandy loam. The underlying material is pale-brown gravelly coarse sand.

Fox soils are nearly level to steep and are well drained. The surface layer typically is dark grayish-brown sandy loam 10 inches thick. The subsurface layer is 4 inches of pale-brown sandy loam. The subsoil is 25 inches thick. The upper part is dark yellowish-brown, very friable gravelly sandy loam; the next part is dark-brown, friable gravelly sandy clay loam; and the lower part is dark-brown, firm gravelly clay loam. The underlying material is pale-brown gravelly sand.

Sebewa soils are nearly level and are poorly drained and very poorly drained. The surface layer typically is mottled very dark brown loam 11 inches thick. The subsoil is mottled and is 22 inches thick. The upper part is dark-gray, friable loam; the next part is mottled grayish-brown, yellowish-brown, and strong-brown, firm heavy loam; and the lower part is dark-gray, friable heavy loam. The underlying material is mottled grayish-brown gravelly sand.

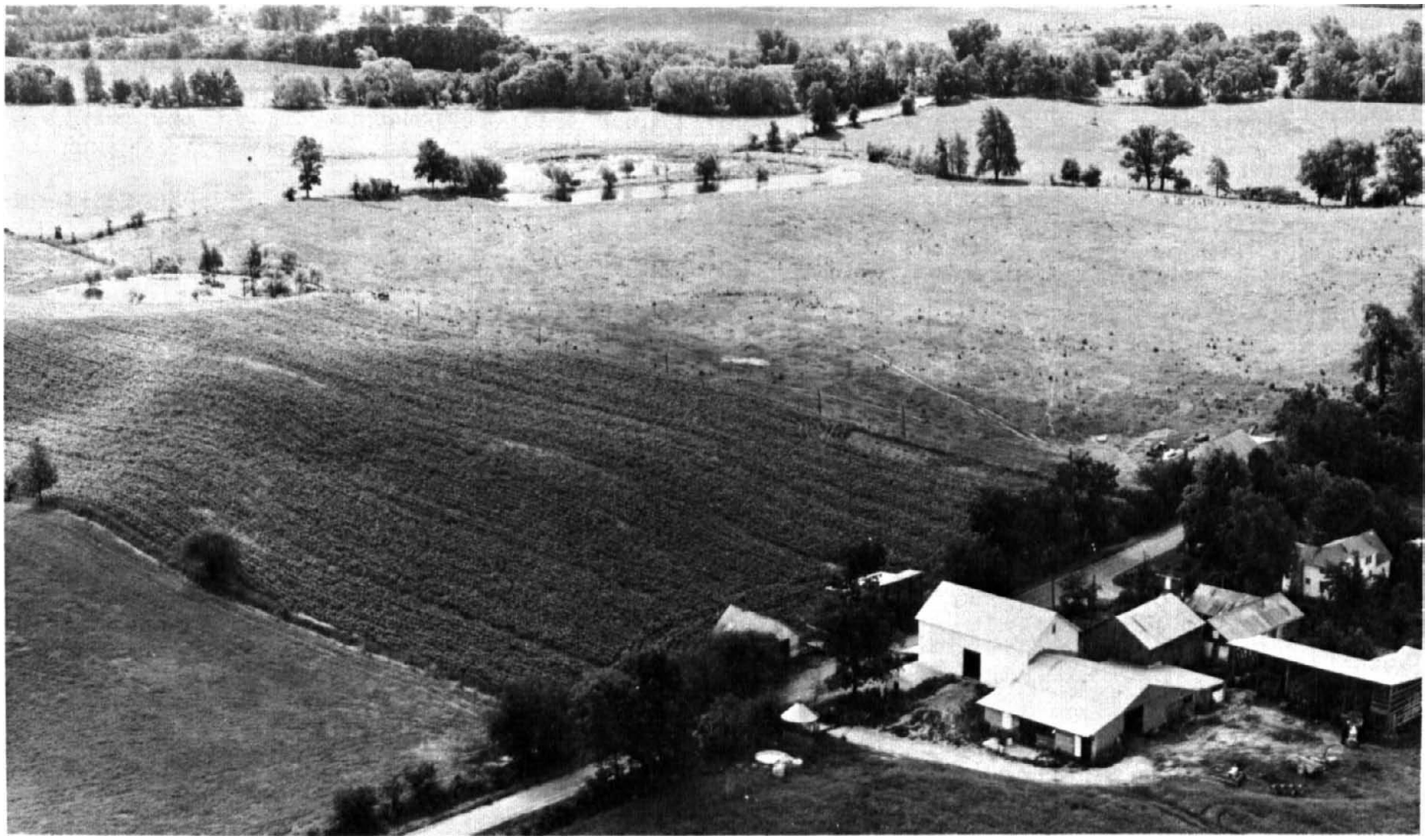

Figure 2.—Crops and pasture on Boyer-Kidder-Houghton association. Boyer and Kidder soils are in high areas and on ridges; Houghton soils are in low areas.

The more extensive minor soils in this association are the Spinks, Matherton, Wasepi, Gilford, and Houghton soils. Spinks soils are in positions similar to those of Boyer and Fox soils. Matherton and Wasepi soils are between the well drained Boyer and Fox soils and the poorly drained and very poorly drained Sebewa soils. Gilford soils are in positions similar to those of Sebewa soils, and Houghton soils are in lower depressional areas.

Most of this association is used for crops. Corn, small grain, and hay are the most commonly grown crops.

In cultivated areas the chief concerns of management are controlling erosion and soil blowing and maintaining soil moisture in the Boyer and Fox soils and artificially draining the Sebewa soils. The poorly drained and very poorly drained Sebewa soils are too wet for most crops unless they are artificially drained.

4. *Spinks-Boyer-Wasepi association*

Nearly level to moderately steep, well drained and somewhat poorly drained soils that have a coarse textured or moderately coarse textured subsoil and coarse textured underlying material; on outwash plains, terraces, lake plains, and deltas

This soil association consists of soils that formed in water-sorted sediments. The soils are mostly nearly level and gently sloping.

This soil association makes up about 4 percent of the county. It is about 37 percent Spinks soils, 22 percent Boyer soils, 11 percent Wasepi soils, and 30 percent soils of minor extent. The well drained, nearly level and gently sloping Spinks and Boyer soils are in broad areas and in short, steeper areas along drainageways. The nearly level and gently sloping, somewhat poorly drained Wasepi soils are in broad, low-lying areas, along streams, and in depressional areas.

Spinks soils are nearly level to moderately steep and are well drained. The surface layer typically is dark grayish-brown loamy sand 10 inches thick. The subsoil is 75 inches thick. The upper part is yellowish-brown, very friable loamy sand, and the lower part is pale-brown, loose fine sand that has bands of dark-brown, friable loamy fine sand. The underlying material is yellowish-brown fine sand.

Boyer soils are nearly level to moderately steep and are well drained. The surface layer typically is dark grayish-brown loamy sand 8 inches thick. The subsurface layer is 10 inches of yellowish-brown loamy sand. The subsoil is 14 inches thick. The upper part is strong-brown, friable sandy loam, and the lower part is brown, firm heavy sandy loam. The underlying material is pale-brown gravelly coarse sand.

Wasepi soils are nearly level or gently sloping and are somewhat poorly drained. The surface layer typically is very dark brown sandy loam 9 inches thick. The subsoil is mottled and is 24 inches thick. The upper part is yellowish-brown, very friable loamy sand; the next part is brown, friable sandy loam; and the lower part is yellowish-brown, very friable loamy sand. The

underlying material is gravelly sand. The upper part is grayish brown, and the lower part is mottled brown.

The more extensive minor soils in this soil association are Thetford, Gilford, Oshtemo, and Fox soils. The somewhat poorly drained Thetford soils and the very poorly drained Gilford soils are in positions similar to those of Wasepi soils. The well drained Oshtemo and Fox soils are closely intermingled with Spinks and Boyer soils.

Most of the soils in this association are used for crops. Corn, soybeans, small grain, and hay are the crops most commonly grown.

The available water capacity is low. The chief concerns of management are controlling erosion and maintaining available water.

5. Fox-Boyer-Fox variant association

Nearly level to moderately steep, well drained soils that have a moderately fine textured or moderately coarse textured subsoil and coarse textured underlying material; on moraines and outwash plains

This soil association consists of soils that formed in water-sorted sediments. The soils are mostly nearly level to sloping.

This association makes up about 5 percent of the county. It is about 30 percent Fox soils, 18 percent Boyer soils, 9 percent Fox variant soils, and 43 percent soils of minor extent. The nearly level and gently sloping soils are on similar landscapes in broad areas. The steeper soils are in areas where slopes are short and complex.

Fox soils are nearly level to moderately steep and are well drained. The surface layer typically is dark grayish-brown sandy loam 10 inches thick. The subsurface layer is 4 inches of pale-brown sandy loam. The subsoil is 25 inches thick. The upper part is dark yellowish-brown, very friable gravelly sandy loam; the next part is dark-brown, friable gravelly sandy clay loam; and the lower part is dark-brown, firm gravelly clay loam. The underlying material is pale-brown gravelly sand.

Boyer soils are nearly level to moderately steep and are well drained. The surface layer typically is dark grayish-brown loamy sand 8 inches thick. The subsurface layer is 10 inches of yellowish-brown loamy sand. The subsoil is 14 inches thick. The upper part is strong-brown, friable sandy loam. The lower part is brown, firm heavy sandy loam. The underlying material is pale-brown gravelly coarse sand.

Fox variant soils are nearly level to moderately steep and are well drained. The surface layer typically is dark grayish-brown cobbly sandy loam 8 inches thick. The subsoil is 19 inches of dark-brown, firm cobbly clay loam. The underlying material is pale-brown gravelly sand.

The more extensive minor soils in this association are Spinks, Sebewa, Matherton, and Wasepi soils. The well drained Spinks soils are in positions similar to those of Fox and Boyer soils. The somewhat poorly drained Matherton and Wasepi soils and the poorly drained Sebewa soils are in depressional areas and along drainageways.

Most of the soils in this association are used for crops. Corn, soybeans, small grain, and hay are the crops most commonly grown.

The available water capacity is moderate or low. The chief concerns of management are controlling erosion and maintaining available water. Cobbles on the surface hinder cultivation of Fox variant soils.

Nearly Level to Very Steep, Well Drained to Very Poorly Drained Soils that are Underlain by Medium Textured to Fine Textured Glacial Till Material

On these associations limitations for urban use range from slight to severe. The major limitations are wetness, shrink-swell, frost action, and slope.

6. Miami-Conover-Brookston association

Nearly level to very steep, well drained to very poorly drained soils that have a medium textured and moderately fine textured subsoil and medium textured underlying material; on till plains and moraines

This soil association consists of soils that formed in loam glacial till. The soils are mostly nearly level to sloping. Most areas of steep and very steep soils are along major streams and drainageways.

This soil association makes up about 26 percent of the county. It is about 44 percent Miami soils, 14 percent Conover soils, 9 percent Brookston soils, and 33 percent soils of minor extent. The well drained, gently sloping to very steep Miami soils are in convex areas. The somewhat poorly drained, gently sloping Conover soils are in concave areas, and the nearly level Conover soils are in low areas. The very poorly drained, nearly level Brookston soils are in low concave areas and in depressional areas.

Miami soils are gently sloping to very steep and are well drained. The surface layer typically is dark grayish-brown loam 8 inches thick. The subsoil is 30 inches thick. The upper part is dark-brown, friable loam; the next part is dark yellowish-brown and yellowish-brown, firm clay loam; and the lower part is dark yellowish-brown, friable loam. The underlying material is yellowish-brown loam.

Conover soils are nearly level and gently sloping and are somewhat poorly drained. The surface layer typically is very dark grayish-brown loam 9 inches thick. The subsoil is mottled and is 18 inches thick. The upper part is dark yellowish-brown, friable loam; the next part is yellowish-brown, firm clay loam; and the lower part is brown, firm silty clay loam. The underlying material is mottled light brownish-gray loam.

Brookston soils are nearly level and are very poorly drained. The surface layer typically is very dark gray loam 11 inches thick. The subsoil is firm and mottled and is 25 inches thick. The upper part is dark-gray clay loam, the next part is gray clay loam and silty clay loam, and the lower part is grayish-brown clay loam. The underlying material is mottled grayish-brown loam.

The more extensive minor soils in this association are Metamora, Kidder, and Owosso soils. The somewhat poorly drained Metamora soils are closely intermingled with Conover and Brookston soils, and the well drained Owosso and Kidder soils are closely intermingled with Miami soils.

Most of this association is used for crops, mainly

Figure 3.—**Urban area on Miami-Conover-Brookston association. Woodland in foreground is on Miami and Conover soils.**

corn, soybeans, small grain, and hay. Part of it is urbanized (fig. 3). Some areas, mostly of steeper soils and undrained soils, are in woodland or permanent pasture. The chief concerns of management are controlling erosion and improving drainage.

7. *Morley-Blount association*

Nearly level to steep, well drained to somewhat poorly drained soils that have a moderately fine textured and fine textured subsoil and moderately fine textured underlying material; on moraines and till plains

This soil association consists of soils that formed in clay loam and silty clay loam glacial till. The soils are mostly nearly level to moderately steep. Some areas of steep soils are along major streams and drainageways.

This soil association makes up about 20 percent of the county. It is about 45 percent Morley soils, 20 percent Blount soils, and 35 percent soils of minor extent. The well drained and moderately well drained, gently sloping to steep Morley soils are in convex areas. The somewhat poorly drained, nearly level and gently sloping Blount soils are in concave areas and low areas.

Morley soils are gently sloping to steep and are well drained and moderately well drained. The surface layer typically is dark grayish-brown loam 7 inches thick. The subsurface layer is 5 inches of yellowish-brown and pale-brown loam. The subsoil is firm and is 20 inches thick. The upper part is dark yellowish-brown clay loam, the next part is yellowish-brown heavy clay loam, and the lower part is brown clay loam. The underlying material is yellowish-brown clay loam.

Blount soils are nearly level and gently sloping and are somewhat poorly drained. The surface layer typically is dark grayish-brown loam 10 inches thick. The subsoil is mottled and is 20 inches thick. The upper part is yellowish-brown, firm heavy clay loam; the next part is brown, firm light clay; and the lower part is brown, firm heavy clay loam. The underlying material is mottled brown clay loam.

The more extensive minor soils in this association are the Pewamo, Metamora, Owosso, and Miami soils. The poorly drained and very poorly drained Pewamo soils are in low concave areas, swales, depressions, and nearly level areas. The somewhat poorly drained Metamora soils are closely intermingled with Blount soils, and the well drained Owosso and Miami soils are closely intermingled with Morley soils.

Most of the soils in this association are used for crops, mainly corn, soybeans, small grain, and hay. Most of the steep soils are in woodland or permanent pasture.

The available water capacity is high. The chief concerns of management are controlling erosion, maintaining tilth, and improving drainage.

8. *St. Clair-Nappanee-Hoytville association*

Nearly level to very steep, moderately well drained to

very poorly drained soils that have a fine textured subsoil and fine textured underlying material; on moraines, till plains, and lake plains

This soil association consists of soils that formed in silty clay or clay deposits. The soils are mostly nearly level to sloping. Most areas of steep soils are along streams and drainageways.

This soil association makes up about 6 percent of the county. It is about 43 percent St. Clair soils, 16 percent Nappanee soils, 7 percent Hoytville soils, and 34 percent soils of minor extent. The well drained and moderately well drained, gently sloping to very steep St. Clair soils are in convex areas. The somewhat poorly drained, nearly level and gently sloping Nappanee soils are in low areas. The very poorly drained Hoytville soils are in nearly level areas and in depressional areas.

St. Clair soils are gently sloping to very steep and are well drained and moderately well drained. The surface layer typically is dark-brown clay loam about 9 inches thick. The subsoil is 16 inches of firm clay. The upper part is yellowish brown, the next part is brown, and the lower part is dark brown. The underlying material is brown clay.

Nappanee soils are nearly level or gently sloping and are somewhat poorly drained. The surface layer typically is dark grayish-brown silty clay loam 8 inches thick. The subsoil is firm, mottled, and brown and is 12 inches thick. The upper part is silty clay, and the lower part is clay. The underlying material is grayish-brown silty clay.

Hoytville soils are nearly level and are very poorly drained. The surface layer typically is silty clay loam 9 inches thick. The upper part is very dark grayish brown, and the lower part is very dark gray. The subsoil is 34 inches of very firm, mottled clay. The upper part is dark gray, and the lower part is gray. The underlying material is mottled grayish-brown clay.

The more extensive minor soils in this soil association are Seward and Houghton soils. The moderately well drained Seward soils are intermingled with St. Clair and Nappanee soils. The very poorly drained Houghton soils are in some of the lower depressions.

Most of the soils in this association are used for crops, mainly corn, soybeans, small grain, and hay. Most of the steep soils are in woodland or permanent pasture.

The chief concerns of management are improving tilth, controlling erosion on the more sloping soils, and improving drainage on the more level and depressional soils.

Nearly Level and Gently Sloping, Somewhat Poorly to Very Poorly Drained Soils that are Underlain by Coarse Textured to Fine Textured Material

These soils have severe limitations for most urban use because they are wet. Also, they are subject to frost damage.

9. Wasepi-Gilford association

Nearly level and gently sloping, somewhat poorly drained and very poorly drained soils that have a mainly moderately coarse textured subsoil and coarse textured underlying material; on deltas and lake plains

This soil association consists of soils that formed in water-sorted sediments. The soils are mostly nearly level.

This association makes up about 3 percent of the county. It is about 45 percent Wasepi soils, 12 percent Gilford soils, and 43 percent soils of minor extent. The somewhat poorly drained Wasepi soils are in nearly level and gently sloping areas and in concave areas. The very poorly drained Gilford soils are in depressions and nearly level areas.

Wasepi soils are nearly level and gently sloping and are somewhat poorly drained. The surface layer typically is very dark brown sandy loam 9 inches thick. The subsoil is mottled and is 24 inches thick. The upper part is yellowish-brown, very friable loamy sand; the next part is brown, friable sandy loam; and the lower part is yellowish-brown, very friable loamy sand. The underlying material is gravelly sand that is grayish brown in the upper part and mottled brown in the lower part.

Gilford soils are nearly level and are very poorly drained. The surface layer typically is black sandy loam 11 inches thick. The subsoil is friable and dark grayish brown and is 17 inches thick. The upper part is sandy loam, and the lower part is light sandy loam. The underlying material is gray gravelly sand.

The more extensive minor soils in this association are the Boyer and Oshtemo soils. These well drained soils are on the higher, gently sloping knolls and ridges.

Most of this association is used for crops, mainly corn and soybeans. A few undrained areas are in woodland.

The available water capacity is low. The chief concern of management is maintaining available water. These soils need artificial drainage for best crop production, but if overdrained, they are droughty.

10. Hoytville-Nappanee association

Nearly level and gently sloping, very poorly drained and somewhat poorly drained soils that have a fine textured subsoil and fine textured underlying material; on till plains and lake plains

This soil association consists of soils that formed in silty clay and clay deposits. The soils are mostly level or gently sloping.

This soil association makes up about 1 percent of the county. It is about 44 percent Hoytville soils, 33 percent Nappanee soils, and 23 percent soils of minor extent. The very poorly drained Hoytville soils are in nearly level to depressional areas. The somewhat poorly drained Nappanee soils are in nearly level and gently sloping areas and in low concave areas.

Hoytville soils are nearly level and are very poorly drained. The surface layer typically is very dark grayish-brown silty clay loam 9 inches thick. The upper 6 inches is very dark grayish-brown silty clay loam. The lower 3 inches is very dark gray heavy silty clay loam. The subsoil is 34 inches of very firm, mottled clay. The upper part is dark gray, and the lower part is gray. The underlying material is mottled grayish-brown clay.

Nappanee soils are nearly level or gently sloping and are somewhat poorly drained. The surface layer is typically dark grayish-brown silty clay loam 8 inches thick. The subsoil is firm, mottled brown and is 12 inches thick. The upper part is silty clay, and the lower

part is clay. The underlying material is grayish-brown silty clay.

The more extensive minor soils in this soil association are Ypsi and Wauseon soils. The somewhat poorly drained Ypsi soils are intermingled with Nappanee and Hoytville soils. The very poorly drained Wauseon soils are intermingled with Hoytville soils.

Most of the soils in this association are used for crops, mainly corn, soybeans, and small grain. The chief concerns of management are improving drainage and tilth and controlling erosion on the gently sloping Nappanee soils.

11. Ypsi-Kibbie-Pella association

Nearly level and gently sloping, somewhat poorly drained to very poorly drained soils that have a coarse-textured to moderately fine textured subsoil and fine textured to coarse textured underlying material; on lake plains and deltas

This soil association consists of soils that formed in stratified sediments. The soils are mostly nearly level and gently sloping. The gentle slopes generally are short.

This soil association makes up about 4 percent of the county. It is about 28 percent Ypsi soils, 14 percent Kibbie soils, 14 percent Pella soils, and 44 percent soils of minor extent. The somewhat poorly drained Ypsi and Kibbie soils are in nearly level and gently sloping areas and in concave areas (fig. 4). The poorly drained Pella soils are in swales, concave areas, depressions, and nearly level areas.

Ypsi soils are nearly level and gently sloping and are somewhat poorly drained. The surface layer typically is very dark grayish-brown sandy loam 9 inches thick. The subsoil is 28 inches thick. The upper part is yellowish-brown, very friable loamy sand; the next part is mottled brown, friable sandy loam; and the lower part is mottled pale-brown, very friable loamy sand. The underlying material is mottled gray silty clay.

Kibbie soils are nearly level and gently sloping and are somewhat poorly drained. The surface layer typically is very dark grayish-brown fine sandy loam 9 inches thick. The subsurface layer is 3 inches of mottled pale-brown fine sandy loam. The subsoil is firm, is mottled brown, and is 17 inches thick. The upper part is sandy clay loam, and the lower part is silty clay loam. The underlying material is mottled pale-brown, stratified fine sand, very fine sand, and silt.

***Figure 4.*—Typical landscape in the Ypsi-Kibbie-Pella association. Ypsi and Kibbie soils in foreground; Pella soil in swale in background.**

Pella soils are nearly level and are poorly drained and very poorly drained. The surface layer typically is very dark brown silt loam 12 inches thick. The subsoil is mottled and is 13 inches thick. The upper part is very dark gray, friable heavy silt loam, and the lower part is gray, firm heavy silt loam. The underlying material is mottled gray, stratified silt loam and silty clay loam.

The more extensive minor soils in this soil association are the Wauseon, Nappanee, Hoytville, and Boyer soils. The somewhat poorly drained Nappanee soils are closely intermingled with Ypsi soils. The very poorly drained Hoytville and Wauseon soils are in swales, concave areas, depressions, and nearly level areas. The well drained Boyer soils are on the higher, gently sloping ridges.

Most of the soils in this association are used for crops, mainly corn and soybeans. A few areas, mostly undrained soils, are in woodland or permanent pasture.

The available water capacity is moderate or high. The chief concern of management is improving drainage.

12. Granby-Thetford-Dixboro association

Nearly level and gently sloping, somewhat poorly drained to very poorly drained soils that have a coarse textured or moderately coarse textured subsoil and coarse textured to medium textured underlying material; on lake plains

This soil association consists of soils that formed in coarse sediments and stratified, coarse textured to medium textured sediments. The soils are mostly nearly level and gently sloping. The gentle slopes generally are short.

This soil association makes up about 3 percent of the county. It is about 15 percent Granby soils, 12 percent Thetford soils, 9 percent Dixboro soils, and 64 percent soils of minor extent. The poorly drained and very poorly drained Granby soils are in swales, concave areas, depressions, and nearly level areas. The somewhat poorly drained Thetford and Dixboro soils are in the slightly higher nearly level and gently sloping and also in concave areas.

Granby soils are nearly level and are poorly drained and very poorly drained. The surface layer typically is very dark gray fine sand 11 inches thick. The subsoil is 27 inches of loose fine sand. The upper part is grayish brown, the next part is mottled grayish brown, and the lower part is mottled light gray. The underlying material is mottled dark grayish-brown and light brownish-gray fine sand.

Thetford soils are nearly level and gently sloping and are somewhat poorly drained. The surface layer typically is dark-brown loamy sand 9 inches thick. The subsoil is 29 inches thick. The upper part is yellowish-brown, very friable loamy sand, and the lower part is mottled, pale-brown, loose sand that has bands of dark

yellowish-brown and dark-brown, friable heavy loamy sand and light sandy loam. The underlying material is brown sand.

Dixboro soils are nearly level and gently sloping and are somewhat poorly drained. The surface layer typically is very dark grayish-brown fine sandy loam 9 inches thick. The subsurface layer is 2 inches of mottled pale-brown fine sandy loam. The subsoil is mottled and is 17 inches thick. The upper part is brown, friable heavy fine sandy loam, the next part is brown, friable fine sandy loam, and the lower part is light yellowish-brown, very friable loamy fine sand. The underlying material is mottled light yellowish-brown, stratified silt loam, fine sandy loam, very fine sand, loam, and fine sand.

The more extensive minor soils in this association are the Lamson, Spinks, Kibbie, Tedrow, and Colwood soils. The well drained Spinks soils are on higher, gently sloping ridges. The somewhat poorly drained Kibbie and Tedrow soils are closely intermingled with Dixboro and Thetford soils. The poorly drained and very poorly drained Lamson and Colwood soils are closely intermingled with Granby soils.

Most of the soils in this association are used for crops, mainly corn and soybeans. A few areas, mostly undrained soils, are in woodland or permanent pasture.

The available water capacity is low or moderate. The chief concerns of management are improving drainage and controlling soil blowing. If overdrained, Granby and Thetford soils are droughty.

Descriptions of the Soils

In this section the soils of Washtenaw County are described and their use and management are discussed. Each soil series is described in detail, and then, briefly, the mapping units in that series. Unless it is specifically mentioned otherwise, what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to the underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for moist soil unless otherwise stated. The profile described in the soil series is representative for mapping units in that series. If a given mapping unit has a profile different from the one described for the series, the differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. The description of each mapping unit contains suggestions on how the soil can be managed.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Made land and Fill land, for example, do not belong to a soil series, but nevertheless, are listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, Michigan soil management group in parentheses, woodland group, woody plant group, and recreation group, in which the mapping unit has been placed. For soil complex mapping units the soil management groups are listed, in parentheses, in the same order as the named series. These groups are used for making recommendations about applications of lime and fertilizer, about artificial drainage, and about other practices. For an explanation of this classification, refer to "Fertilizer Recommendations for Michigan Vegetables and Field Crops" (*3*). The page for description of each capability unit can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the "Glossary," and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*5*).

The names, descriptions, and delineations of soils in this survey do not always agree with soils on maps of adjoining counties published at an earlier date. Differences are caused by better knowledge about soils or modifications and refinements in soil series concepts. In addition, the correlation of a recognized soil is based upon the acreage of that soil and the dissimiliarity to adjacent soils within the survey area. Frequently, it is more feasible to include soils that are small in extent with similar soils, where management and response is much the same, rather than to set them apart as individual soils. The soil descriptions reflect these combinations. Other differences are brought about by the predominance of different soils in units made up of two or three series. Still another difference can be caused by the range in slope allowed within the mapping unit for each survey.

Adrian Series

The Adrian series consists of very poorly drained, nearly level soils formed in organic deposits overlying gravelly sand. These soils are on lake plains, outwash plains, till plains, and moraines.

In a representative profile the surface layer is black muck 8 inches thick. The next layer is very dark brown and dark reddish-brown muck 18 inches thick. The underlying material is dark-gray gravelly sand.

Adrian soils have a high available water capacity. Permeability is rapid.

Most areas of these soils are used for wildlife and woodland. Some areas are in crops or permanent pasture.

Representative profile of Adrian muck, 120 feet north and 210 feet west of the center sec. 22, T. 2 S., R. 5 E., in a cultivated area:

Oa1—0 to 8 inches, black (10YR 2/1) sapric material; moderate, medium, granular structure; very friable; less than 5 percent fiber; neutral; abrupt, smooth boundary.

Oa2—8 to 15 inches, sapric material, very dark brown (10YR 2/2) broken face, black (10YR 2/1)

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Adrian muck	6,860	1.5	Miami loam, 18 to 25 percent slopes	1,475	0.3
Blount loam, 0 to 2 percent slopes	935	.2	Miami loam, 25 to 35 percent slopes	1,030	.3
Blount loam, 2 to 6 percent slopes	22,585	4.9	Morley loam, 2 to 6 percent slopes	25,310	5.4
Boyer loamy sand, 0 to 6 percent slopes	16,905	3.6	Morley loam, 6 to 12 percent slopes	16,735	3.6
Boyer loamy sand, 6 to 12 percent slopes	8,520	1.9	Morley loam, 12 to 18 percent slopes	2,630	.6
Boyer loamy sand, 12 to 18 percent slopes	3,590	.8	Morley loam, 18 to 25 percent slopes	1,075	.3
Boyer loamy sand, 18 to 25 percent slopes	2,950	.6	Nappanee silty clay loam, 0 to 2 percent slopes	2,225	.5
Boyer loamy sand, 25 to 40 percent slopes	4,005	.9	Nappanee silty clay loam, 2 to 6 percent slopes	4,640	1.0
Boyer-Kidder complex, 15 to 35 percent slopes	2,595	.6	Oakville fine sand, 0 to 6 percent slopes	725	.2
Brookston loam	9,410	2.0	Oakville fine sand, 6 to 12 percent slopes	500	.1
Cohoctah fine sandy loam, frequently flooded	2,995	.7	Oshtemo loamy sand, 0 to 6 percent slopes	6,260	1.4
Conover loam, 0 to 4 percent slopes	14,515	3.1	Oshtemo loamy sand, 6 to 12 percent slopes	4,265	.9
Conover-Brookston loams, 0 to 2 percent slopes	3,985	.9	Owosso-Miami complex, 2 to 6 percent slopes	3,760	.8
Dixboro-Kibbie fine sandy loams, 0 to 4 percent slopes	2,460	.6	Owosso-Miami complex, 6 to 12 percent slopes	1,560	.4
Edwards muck	1,850	.4	Palms muck	3,305	.7
Edwards muck, shallow variant	1,780	.4	Pella silt loam	4,920	1.1
Fill land	380	.1	Pewamo clay loam	14,000	3.0
Fox sandy loam, 0 to 2 percent slopes	4,095	.9	Riddles sandy loam, 2 to 6 percent slopes	710	.2
Fox sandy loam, 2 to 6 percent slopes	16,280	3.5	Riddles sandy loam, 6 to 12 percent slopes	710	.2
Fox sandy loam, 6 to 12 percent slopes	7,580	1.6	Sebewa loam	9,465	2.0
Fox sandy loam, 12 to 18 percent slopes	2,950	.6	Seward loamy fine sand, 2 to 6 percent slopes	1,120	.3
Fox sandy loam, 18 to 25 percent slopes	1,310	.3	Seward loamy fine sand, 6 to 12 percent slopes	480	.1
Fox cobbly sandy loam, cobbly variant, 2 to 6 percent slopes	1,250	.3	Seward sandy loam, loamy subsoil variant, 2 to 6 percent slopes	1,185	.3
Fox cobbly sandy loam, cobbly variant, 6 to 12 percent slopes	815	.2	Sisson fine sandy loam, 2 to 6 percent slopes	1,970	.5
Fox cobbly sandy loam, cobbly variant, 12 to 18 percent slopes	505	.1	Sisson fine sandy loam, 6 to 12 percent slopes	1,150	.3
Gilford sandy loam	5,830	1.3	Sloan silt loam, wet	5,080	1.1
Granby fine sand	2,335	.5	Spinks loamy sand, 0 to 6 percent slopes	13,595	2.9
Houghton muck	24,150	5.2	Spinks loamy sand, 6 to 12 percent slopes	8,150	1.9
Hoytville silty clay loam	5,780	1.2	Spinks loamy sand, 12 to 18 percent slopes	2,620	.6
Kendallville loam, 2 to 6 percent slopes	3,130	.7	Spinks loamy sand, 18 to 25 percent slopes	2,010	.5
Kendallville loam, 6 to 12 percent slopes	850	.2	Spinks-Oshtemo loamy sands, 0 to 6 percent slopes	2,115	.5
Kibbie fine sandy loam, 0 to 4 percent slopes	4,630	1.0	St. Clair clay loam, 2 to 6 percent slopes	8,100	1.8
Kidder sandy loam, 2 to 6 percent slopes	3,470	.8	St. Clair clay loam, 6 to 12 percent slopes	4,590	1.0
Kidder sandy loam, 6 to 12 percent slopes	3,090	.7	St. Clair clay loam, 12 to 18 percent slopes	865	.2
Kidder sandy loam, 12 to 18 percent slopes	1,445	.3	St. Clair clay loam, 18 to 35 percent slopes	810	.2
Lamson-Colwood complex	2,800	.6	Tedrow loamy fine sand, 0 to 4 percent slopes	1,055	.3
Macomb loam, 0 to 4 percent slopes	1,085	.3	Thetford loamy sand, 0 to 4 percent slopes	3,725	.8
Made land	745	.2	Wasepi sandy loam, 0 to 4 percent slopes	11,415	2.4
Matherton sandy loam, 0 to 4 percent slopes	6,885	1.5	Wauseon fine sandy loam	2,185	.5
Metamora sandy loam, 0 to 4 percent slopes	1,810	.4	Ypsi sandy loam, 0 to 4 percent slopes	5,910	1.3
Miami loam, 2 to 6 percent slopes	32,470	6.9	Miscellaneous	2,845	.6
Miami loam, 6 to 12 percent slopes	17,800	3.8	Water	8,070	1.7
Miami loam, 12 to 18 percent slopes	4,245	.9	Total	458,000	100.0

rubbed; weak, thick, platy structure; friable; 10 percent fiber, less than 5 percent rubbed; neutral; gradual, wavy boundary.

Oa3—15 to 26 inches, sapric material, very dark brown (10YR 2/2) and dark reddish brown (5YR 3/4) broken face, black (10YR 2/1) rubbed; weak, thick, platy structure; friable; 15 percent fiber, less than 5 percent rubbed; neutral; abrupt, smooth boundary.

IICg—26 to 60 inches, dark-gray (5Y 4/1) gravelly sand; single grained; loose; 45 percent pebbles; mildly alkaline.

The depth to the IICg horizon ranges from 16 to 50 inches. The reaction of the organic material ranges from medium acid to mildly alkaline. In some pedons woody fragments make up about 10 percent of the organic material. The organic material is less than 25 percent fiber unrubbed and less than 5 percent fiber rubbed. The content of gravel in the IICg horizon ranges from 0 to 50 percent. This horizon is effervescent in some pedons.

The Adrian soils in most landscapes are near the Houghton, Palms, and Edwards soils. They have a thinner organic layer than the Houghton soils, and they have coarser underlying material than the Palms soils. They are underlain by sand, whereas the Edwards soils are underlain by marl.

Ad—Adrian muck. This soil is in depressional areas, broad low-lying areas, and along waterways of lake plains, outwash plains, till plains, and moraines. Areas are irregular in shape and range from 3 to more than 150 acres in size. Slope is 0 to 2 percent.

Included with this soil in mapping are small areas of Houghton muck, Edwards muck, Granby fine sand, and Gilford sandy loam.

This soil is too wet to be used for crops unless drained. It has a high water table and is subject to flooding. When cleared and drained, this soil is subject to soil blowing, subsidence, burning, and frost damage. Runoff is very slow.

Most of the acreage is used for wildlife and woodland. Some areas are used for crops or permanent pasture. Capability unit IVw–1 (M/4c); woodland group 4w2; woody plant group 1; recreation group 1.

Blount Series

The Blount series consists of somewhat poorly drained, nearly level and gently sloping soils formed in loamy textured glacial till. These soils are on till plains and moraines.

In a representative profile the surface layer is dark grayish-brown loam 10 inches thick. The subsoil is mottled and is 20 inches thick. The upper part is yellowish-brown, firm heavy clay loam, the next part is brown, firm light clay, and the lower part is brown, firm heavy clay loam. The underlying material is mottled brown clay loam.

Blount soils have a high available water capacity. Permeability is moderately slow.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Blount loam, 2 to 6 percent slopes, 330 feet west and 218 feet south of the northeast corner of NW¼ sec. 25, T. 4 S., R. 4 E., in a cultivated area:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) loam; weak, medium, subangular blocky structure; friable; 5 percent pebbles; slightly acid; abrupt, smooth boundary.

B2lt—10 to 14 inches, yellowish-brown (10YR 5/4) heavy clay loam; common, fine, prominent, strong-brown (7.5YR 5/6) mottles; strong, fine, angular blocky structure; firm; common, thick, grayish-brown (10YR 5/2) clay films on vertical faces of peds; 2 percent pebbles; neutral; clear, wavy boundary.

B22t—14 to 23 inches, brown (10YR 4/3) light clay; common, fine, prominent, strong-brown (7.5YR 5/6) and few, fine, distinct, dark-gray (10YR 4/1) mottles; moderate, coarse, prismatic structure parting to strong, fine and medium, angular blocky; firm; continuous, thick, grayish-brown (10YR 5/2) clay films on all faces of peds; 2 percent pebbles; neutral; gradual, smooth boundary.

B23t—23 to 30 inches, brown (10YR 5/3) heavy clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) and few, fine, distinct, dark-gray (10YR 4/1) mottles; weak, coarse, prismatic structure parting to strong, fine and medium, angular blocky; firm; continuous, thick, grayish-brown (10YR 5/2) clay films on all faces of peds; 2 percent pebbles; neutral; clear, smooth boundary.

C—30 to 60 inches, brown (10YR 5/3) clay loam; common, medium, distinct, yellowish-brown, (10YR 5/6) mottles; moderate, medium, platy structure parting to moderate, very fine, subangular blocky; firm; 4 percent pebbles; common gray (10YR 6/1) lime segregations; strong effervescence; mildly alkaline.

The solum ranges from 20 to 40 inches in thickness, which coincides with depth to effervescent material. The reaction of the solum ranges from medium acid to neutral. Pebbles range from 1 to 5 percent throughout the profile.

The Ap horizon is dark gray (10YR 4/1) or dark grayish brown (10YR 4/2) and ranges from 6 to 10 inches in thickness. In places an A2 horizon is present. It is pale-brown (10YR 6/3), grayish-brown (10YR 5/2), or brown (10YR 5/3) loam and ranges from 1 to 6 inches in thickness. In uncultivated areas an A1 horizon is present and the A2 horizon is near maximum thickness. The A1 horizon is very dark gray (10YR 3/1) or very dark grayish-brown (10YR 3/2) loam and ranges from 3 to 5 inches in thickness.

The B1 horizon, if present, is brown (10YR 5/3) or yellowish brown (10YR 5/4, 5/6) and is mottled in many pedons. It is clay loam or heavy loam. The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 4 and is mottled. It is silty clay, light clay, heavy clay loam, or heavy silty clay loam.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4, and is mottled. It is clay loam or silty clay loam.

The Blount soils in most landscapes are near the Morley and Pewamo soils. They differ from Morley soils in having gray mottles in the subsoil, and they are less gray in the subsoil than Pewamo soils.

BbA—Blount loam, 0 to 2 percent slopes. This soil is in depressional areas, in broad low-lying areas, and along drainageways of till plains and moraines. Areas are irregular in shape and range from 5 to about 40 acres in size.

This soil has a profile similar to the one described as representative of the series, but the subsoil is slightly thicker.

Included with this soil in mapping are small areas of Pewamo clay loam, Morley loam, and Metamora sandy loam. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

This soil has a seasonal high water table and is subject to ponding. Runoff is very slow.

Most areas of this soil are used for crops. Some small areas are in woodland. Capability unit IIw–2 (1.5b); woodland group 2o4; woody plant group 2; recreation group 2.

BbB—Blount loam, 2 to 6 percent slopes. This soil is on foot slopes and along drainageways of till plains and moraines. Areas are irregular in shape and range from 5 to more than 200 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Pewamo clay loam, Morley loam, and Metamora sandy loam. Some small areas of poorly drained, very poorly drained, and steeper soils are identified on the soil map by spot symbols. Small areas of nearly level soils are also included.

The hazard of erosion is slight. The water table is seasonally high. Runoff is medium or slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIe–4 (1.5b); woodland group 2o4; woody plant group 2; recreation group 2.

Boyer Series

The Boyer series consists of well-drained, nearly level to very steep soils formed in loamy and sandy deposits underlain by gravelly coarse sand. These soils are on outwash plains, kames, valley trains, terraces, and moraines.

In a representative profile the surface layer is dark grayish-brown loamy sand 8 inches thick. The subsurface layer is 10 inches of yellowish-brown loamy sand. The subsoil is 14 inches thick. The upper part is strong-brown, friable sandy loam. The lower part is brown, firm heavy sandy loam. The underlying material is pale-brown gravelly coarse sand.

Boyer soils have a low available water capacity. Permeability is moderately rapid.

Most of the acreage is used for crops, recreation, and

woodland. Some areas are mined for sand and gravel.

Representative profile of Boyer loamy sand, 0 to 6 percent slopes, 400 feet south and 250 feet west of the northeast corner sec. 21, T. 2 S., R. 5 E., in a cultivated area:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loamy sand; weak, medium, granular structure; very friable; 4 percent pebbles; slightly acid; abrupt, smooth boundary.

A2—8 to 18 inches, yellowish-brown (10YR 5/4) loamy sand; weak, medium, granular structure; very friable; 4 percent pebbles; slightly acid; clear, wavy boundary.

B21t—18 to 27 inches, strong-brown (7.5YR 5/6) sandy loam; weak, medium, subangular blocky structure; friable; common, thin clay films on faces of peds; 8 percent pebbles; slightly acid; gradual, wavy boundary.

B22t—27 to 32 inches, brown (7.5YR 4/4) heavy sandy loam; weak, medium, subangular blocky structure; firm; common, thin clay films on faces of peds; 12 percent pebbles; neutral; abrupt, irregular boundary.

IIC—32 to 60 inches, pale-brown (10YR 6/3) gravelly coarse sand; single grained; loose; 16 percent pebbles; strong effervescence; mildly alkaline.

The solum is 24 to 40 inches thick, which coincides with depth to the effervescent material. In most places, the solum is medium acid to slightly acid in the upper part and slightly acid to mildly alkaline in the lower part. Pebble content ranges from less than 5 percent to 25 percent in the solum and from 10 to 65 percent in the underlying material.

The Ap horizon is very dark grayish-brown (10YR 3/2), dark grayish-brown (10YR 4/2), or dark-brown (10YR 3/3, 4/3) loamy sand or sandy loam. The A2 horizon is pale brown (10YR 6/3), brown (10YR 5/3), or yellowish brown (10YR 5/4). In cultivated areas the A1 horizon is very dark grayish-brown (10YR 3/2) or dark-brown (10YR 3/3) loamy sand or sandy loam and the A2 horizon is near maximum thickness.

The B1 horizon, if present, is dark yellowish-brown (10YR 4/4) or yellowish-brown (10YR 5/4, 5/6) loamy sand or sandy loam. The B2t horizon is dark-brown (7.5YR 4/4), strong-brown (7.5YR 5/6), reddish-brown (5YR 4/4), or dark yellowish-brown (10YR 4/4) sandy loam or gravelly sandy loam. A B3 horizon occurs in some pedons, and it has colors like those of the B2t horizon.

The IIC horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4.

The Boyer soils are generally near Wasepi, Fox, Oshtemo, and Owosso soils in most landscapes. They lack the gray mottles in the subsoil, which are characteristic of the Wasepi soils. They have less clay in the subsoil than the Fox soils and have a thinner solum than the Oshtemo soils. They have less silt and clay and more sand in the underlying material than the Owosso soils.

BnB—Boyer loamy sand, 0 to 6 percent slopes. This soil is on broad uplands, and on outwash plains, kames, valley trains, terraces, and moraines. Slopes are uniform in the uplands and are short and complex in other areas. Areas are irregular in shape and range from 3 to about 400 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Wasepi sandy loam, Fox sandy loam, Oshtemo loamy sand, Gilford sandy loam, and Sisson fine sandy loam. Some small areas of poorly drained and steeper soils are identified on the soil map by spot symbols.

This soil is droughty and is subject to soil blowing when cultivated. Runoff is slow or very slow.

Most of the acreage is used for crops, recreation, and woodland. Some areas are mined for sand and gravel. Capability unit IIIs–1 (4a); woodland group 2s5; woody plant group 3; recreation group 3.

BnC—Boyer loamy sand, 6 to 12 percent slopes. This soil is on outwash plains, kames, valley trains, terraces, and moraines. Slopes are uniform or short and complex. Areas are irregular in shape and range from 3 to about 230 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is slightly less. The subsurface layer and some of the subsoil are incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Wasepi sandy loam, Fox sandy loam, Oshtemo loamy sand, Spinks loamy sand, Kendallville loam, small areas of soils that are less than 24 inches deep over the underlying sand, and small areas of gently sloping soils. Also included and identified on the soil map by spot symbols are small areas of poorly drained soils, very poorly drained soils, steeper soils, and depressions.

Where this soil is cultivated, erosion is a moderate hazard and the soil is droughty and subject to soil blowing. Runoff is slow. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops, recreation, and woodland. Some areas are mined for sand and gravel. Capability unit IIIe–3 (4a); woodland group 2s5; woody plant group 3; recreation group 4.

BnD—Boyer loamy sand, 12 to 18 percent slopes. This soil is on pitted outwash areas and along streams and drainageways of outwash plains, kames, valley trains, terraces, and moraines. Areas are irregular in shape and range from 3 to about 55 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is less. The subsurface layer and some of the subsoil are incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Kendallville loam, Fox sandy loam, Oshtemo loamy sand, Spinks loamy sand, Wasepi sandy loam, many small areas of severely eroded soils that are less than 24 inches deep over the underlying sandy material, and small areas of sloping soils. Also included, and identified on the soil map by spot symbols, are small areas of wet depressional soils, steeper soils, and depressions.

When this soil is cultivated, erosion is a severe hazard, and the soil is droughty and subject to soil blowing. Runoff is medium. Complex slopes make tillage difficult.

Most of the acreage is used for woodland, permanent pasture, and recreation. Small areas are used for crops or are mined for sand and gravel. Capability unit IVe–3 (4a); woodland group 2s5; woody plant group 3; recreation group 5.

BnE—Boyer loamy sand, 18 to 25 percent slopes. This soil is in pitted outwash areas and along streams and drainageways of outwash plains. Most areas are irregular in shape, but some are long and narrow. They range from 3 to 185 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is less. Many areas also have a thinner, darker colored surface layer.

Included with this soil in mapping are small areas of Miami loam, Fox sandy loam, Spinks loamy sand, many small areas of severely eroded soils that are less than 24 inches deep over the underlying sandy material, and small areas of moderately steep and very steep soils. Also included and identified on the soil map by spot symbols are small areas of wet depressional soils and depressions.

The hazard of erosion is very severe. This soil is also droughty and subject to soil blowing. Runoff is rapid.

Most of the acreage is used for recreation, woodland, and wildlife. Some areas are used for permanent pasture. Some are mined for sand and gravel. Capability unit VIe–2 (4a); woodland group 2s6; woody plant group 3; recreation group 5.

BnF—Boyer loamy sand, 25 to 40 percent slopes. This soil is in pitted outwash areas and along major streams and drainageways of outwash plains. Some areas are irregular in shape, and others are long and narrow. They range from 3 to about 330 acres in size.

This soil has a profile similar to that described as representative of the series, but depth to the underlying material is less. Many areas also have a much thinner, darker colored surface layer.

Included with this soil in mapping are small areas of Miami loam, Fox sandy loam, Spinks loamy sand, many small areas of severely eroded soils that are less than 25 inches deep over the underlying sandy material, and small areas of steep soils that have a slope of more than 40 percent. Also included and identified on the soil map by spot symbols are small areas of wet depressional soils and depressions.

The hazard of erosion is very severe. This soil is also droughty and subject to soil blowing. Runoff is rapid.

Most of the acreage is used for recreation, woodland, and wildlife. Some areas are mined for sand and gravel. Capability unit VIIe–1 (4a); woodland group 2s6; woody plant group 3; recreation group 6.

BoE—Boyer-Kidder complex, 15 to 35 percent slopes. This mapping unit is on moraines. Areas are irregular in shape and range from about 30 to more than 500 acres in size.

The Boyer soils in this unit have a profile similar to the one described as representative of the series but shallower over the underlying material. The Kidder soils have a profile similar to the one described as representative of the Kidder series, but more sand is in the underlying material. In many areas the surface layer of both soils is thinner and darker colored than is typical. Boyer soils make up about 45 percent of the acreage, and Kidder soils make up about 25 percent.

Included in mapping and making up about 30 percent of the acreage are small areas of Fox sandy loam, Spinks loamy sand, Oshtemo loamy sand, Riddles sandy loam, many areas of severely eroded soils, small areas of sloping soils, and soils that have slopes of more than 35 percent. Also included and identified on the soil map by spot symbols are wet depressional soils and depressions.

The hazard of erosion is very severe. Much of this mapping unit is droughty and subject to soil blowing. Runoff is rapid and very rapid.

Most of the acreage is used for permanent pasture, woodland, recreation, or wildlife. Some areas are mined for sand and gravel. Capability unit VIe–2 (2.5a); recreation group 5; Boyer soil in woodland group 2s6, woody plant group 3; Kidder soil in woodland group 1r1, woody plant group 4.

Brookston Series

This series consists of very poorly drained, nearly level soils on till plains and moraines. These soils formed in loamy glacial till.

In a representative profile the surface layer is very dark gray loam 11 inches thick. The subsoil is firm and mottled and is 25 inches thick. The upper part is dark-gray clay loam. The next part is gray clay loam and silty clay loam. The lower part is grayish-brown clay loam. The underlying material is mottled grayish-brown loam.

Brookston soils have a high available water capacity. Permeability is moderate.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Brookston loam, 500 feet west and 40 feet south of the northeast corner of NW¼ sec. 29, T. 2 S., R. 4 E., in a cultivated area:

Ap—0 to 11 inches, very dark gray (10YR 3/1) loam; weak, medium, granular structure; friable; many fine roots; 2 percent pebbles and cobbles; neutral; abrupt, smooth boundary.

B1g—11 to 13 inches, dark-gray (10YR 4/1) clay loam; common, fine, faint, grayish-brown (10YR 5/2) mottles; weak, coarse, subangular blocky structure; firm; common fine roots; 2 percent pebbles and cobbles; neutral; clear, wavy boundary.

B21tg—13 to 21 inches, gray (10YR 5/1) clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; firm; common fine roots; dark-gray (10YR 4/1) clay films on faces of peds and on faces of worm and root channels; 3 percent pebbles and cobbles; neutral; gradual, wavy boundary.

B22tg—21 to 27 inches, gray (10YR 5/1) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium subangular blocky structure; firm; few fine roots; dark-gray (10YR 4/1) clay films on faces of peds; 3 percent pebbles and cobbles; neutral; clear, wavy boundary.

B3g—27 to 36 inches, grayish-brown (10YR 5/2) clay loam; common, medium, distinct, yellowish-brown (10YR 5/4) and gray (10YR 5/1) mottles; weak, coarse, subangular blocky structure; firm; 3 percent pebbles and cobbles; neutral; clear, irregular boundary.

Cg—36 to 60 inches, grayish-brown (10YR 5/2) loam; common, medium, distinct, yellowish-brown (10YR 5/4) and gray (10YR 5/1) mottles; massive; friable; 5 percent pebbles and cobbles; slight effervescence; mildly alkaline.

The solum is 30 to 48 inches thick, which coincides with depth to the effervescent material. Content of cobbles and pebbles ranges from 1 to 10 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The B1g horizon is gray (10YR 5/1) or dark-gray (10YR 4/1) clay loam or loam and is mottled. The B2g horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2 and is mottled. The B3 horizon is gray (10YR 5/1, 6/1), grayish-brown (10YR 5/2), or brown (10YR 5/3) clay or clay loam. It is mottled.

The Cg horizon is gray (10YR 5/1, 6/1) grayish brown (10YR 5/2), light gray (10YR 7/1), or brown (10YR 5/3) and is mottled.

Brookston soils are generally near Conover, Metamora, and Pewamo soils on the landscape. They are more gray in the subsoil than Conover and Metamora soils and have less

sand and more clay in the upper part of the subsoil than Metamora soils. They have more sand and less clay in the subsoil and underlying material than Pewamo soils.

Br—Brookston loam. This soil is in depressional areas, broad low-lying areas, and drainageways of till plains and moraines. Slopes are 0 to 2 percent. Areas are irregular in shape and range from 3 to 480 acres in size.

Included with this soil in mapping are small areas of Sebewa loam, Pewamo clay loam, Hoytville silty clay loam, and Conover loam. Also included are small areas of soils that have a solum less than 30 inches thick, small areas of organic soils, and small areas of gently sloping soils.

This soil has a high water table and is too wet for crop production unless drained. Runoff is very slow. Depressional areas are subject to flooding by runoff from adjacent areas.

Most of the acreage is used for crops. Some small areas are in woodland or permanent pasture. Capability unit IIw–4 (2.5c); woodland group 2w1; woody plant group 5, recreation group 7.

Cohoctah Series

The Cohoctah series consists of poorly drained, nearly level soils formed in stratified loamy alluvial deposits (fig. 5). These soils are on the flood plains of streams and rivers.

In a representative profile the surface layer is very dark gray fine sandy loam 10 inches thick. The underlying material, to a depth of 60 inches, is mottled. The upper part is stratified, very dark gray fine sandy loam and dark grayish-brown loamy fine sand. The next part is stratified very dark gray loam and grayish-brown fine sand. The lower part is black light loam and gray sandy loam.

Cohoctah soils have a moderate available water capacity. Permeability is moderately rapid.

Most of the acreage is used for wildlife, woodland, and permanent pasture. Some small areas are in crops.

Representative profile of Cohoctah fine sandy loam, frequently flooded, 525 feet east and 990 feet north of the southwest corner sec. 18, T. 2 S., R. 5 E., in a cultivated area:

Ap—0 to 10 inches, very dark gray (10YR 3/1) fine sandy loam; weak, fine granular structure; friable; common fine roots; strong effervescence; mildly alkaline; abrupt, smooth boundary.

C1g—10 to 24 inches, stratified very dark gray (10YR 3/1) fine sandy loam and dark grayish-brown (10YR 4/2) loamy fine sand; weak, fine, subangular blocky structure; friable; common fine roots; strong effervescence; mildly alkaline; clear, smooth boundary.

C2g—24 to 30 inches, very dark gray (10YR 3/1) fine sandy loam; few, fine, faint, dark-gray (10YR 4/1) mottles; weak, fine, subangular blocky structure; friable; common fine roots; slight effervescence; mildly alkaline; clear, smooth boundary.

C3g—30 to 35 inches, stratified very dark gray (10YR 3/1) loam and grayish-brown (10YR 5/2) fine sand; few fine, faint, dark-gray (10YR 4/1) and few, fine, prominent, yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; friable; slight effervescence; mildly alkaline; clear, smooth boundary.

Figure 5.—Typical pastured area of Cohoctah fine sandy loam, frequently flooded, along Mill Creek.

C4g—35 to 44 inches, black (10YR 3/1) light loam; few, fine, prominent, reddish-brown (5YR 4/4) and few, fine, faint, dark grayish-brown (10YR 4/2) mottles; weak, fine, subangular blocky structure; friable; slight effervescence; mildly alkaline; gradual, smooth boundary.

C5g—44 to 60 inches, gray (10YR 5/1) sandy loam; many, medium, prominent, yellowish-brown (10YR 5/6) mottles; massive; friable; slight effervescence; mildly alkaline.

The reaction of the soil is mildly alkaline or moderately alkaline and effervescence ranges from slight to violent. Some pedons are as much as 5 percent pebbles, by volume.

The A horizon is very dark gray (10YR 3/1), very dark grayish-brown (10YR 3/2), or very dark brown (10YR 2/2) fine sandy loam or sandy loam.

The Cg horizon is black (10YR 3/1), dark grayish brown (10YR 4/2), very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), dark gray (10YR 4/1), or gray (10YR 5/1). Some pedons contain thin strata of sand.

The depth to effervescent material is less than is defined for the series. This difference does not significantly affect use and management.

The Cohoctah soils are generally near the Sloan soils on the landscape. They contain less clay than the Sloan soils.

Cc—Cohoctah fine sandy loam, frequently flooded. This soil is on alluvial flood plains of streams and rivers. Slope is 0 to 2 percent. Areas are elongated and range from 3 to about 100 acres in size.

Included with this soil in mapping are many small areas of Sloan silt loam. Small areas of Sebewa loam, Gilford sandy loam, organic soils, and somewhat poorly drained soils are also included.

This Cohoctah soil has a high water table and is subject to flooding. It is too wet for crop production unless drained and protected from flooding. Runoff is slow.

Most of the acreage is used for wildlife, woodland, and permanent pasture. Some small areas are in crops. Capability unit Vw–1 (L–2c); woodland group 2w1; woody plant group 5; recreation group 8.

Colwood Series

The Colwood series consists of poorly drained and very poorly drained, nearly level soils formed in stratified deposits that have alternating layers of sandy and loamy textured sediments. These soils are on lake plains and outwash plains.

In a representative profile the surface layer is loam 12 inches thick. It is very dark brown in the upper part and black in the lower part. The subsoil is mottled and is 20 inches thick. The upper part is grayish-brown, friable light clay loam, and the lower part is gray, firm and friable sandy clay loam. The underlying material is mottled yellowish-brown and grayish-brown stratified fine sand, very fine sand, and silt loam.

Colwood soils have a high available water capacity. Permeability is moderate. Most of the acreage is used for crops. Some small areas are in woodland.

The Colwood soils in this county are mapped only with Lamson soils.

Representative profile of Colwood loam, 125 feet north and 930 feet east of the southwest corner of the SE¼ sec. 21, T. 4 S., R. 7 E., in a cultivated area of Lamson-Colwood complex:

Ap—0 to 9 inches, very dark gray (10YR 3/1) loam, grayish brown (10YR 5/2) dry; moderate, fine, subangular blocky structure; friable; neutral; abrupt, smooth boundary.

A12—9 to 12 inches, black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate, fine, subangular blocky structure; friable; neutral; clear, wavy boundary.

B1g—12 to 18 inches, grayish-brown (10YR 5/2) light clay loam; few, fine, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; friable; very dark gray (10YR 3/1) worm casts; neutral; clear, wavy boundary.

B21g—18 to 25 inches, gray (10YR 5/1) sandy clay loam; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; firm; dark gray (10YR 4/1) coatings on faces of some peds and in some pores; mildly alkaline; clear, wavy boundary.

B22g—25 to 32 inches, gray (10YR 5/1) sandy clay loam; many, medium, distinct, yellowish-brown (10YR 5/6 and 10YR 5/8) mottles; moderate, medium, subangular blocky structure; friable; mildly alkaline; abrupt, wavy boundary.

C—32 to 60 inches, stratified yellowish-brown (10YR 5/8) fine sand and very fine sand and grayish-brown (10YR 5/2) silt loam; massive; very friable and friable; very dark gray (10YR 3/1) worm casts; violent effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness. It ranges from slightly acid to mildly alkaline.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loam, silt loam, fine sandy loam, or very fine sandy loam.

The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2 and is mottled. Individual layers are yellowish brown (10YR 5/4, 5/6, 5/8) or light olive brown (2.5Y, 5/4, 5/6). This horizon is loam, heavy loam, clay loam, sandy clay loam, light silty clay loam, silt loam, or heavy fine sandy loam. Thin strata of silt, fine sand, very fine sand, or silty clay are also in the B horizon.

The C horizon commonly has hue of 10YR, 5Y or 2.5Y, value of 4 to 8, and chroma of 1 or 2, but there are some individual layers of brighter colors. This horizon is stratified silt loam, fine sand, and very fine sand. In many pedons strata of clay, silty clay or loamy sand are in the C horizon.

The Colwood soils are generally near Kibbie, Lamson, and Pella soils in most landscapes. They are more gray in the subsoil than the Kibbie soils. They have more clay in the subsoil than the Lamson soils, and they contain more sand in the subsoil than the Pella soils.

Conover Series

The Conover series consists of somewhat poorly drained, nearly level, and gently sloping soils formed in loamy textured glacial till. These soils are on till plains and moraines.

In a representative profile the suface layer is very dark grayish-brown loam 9 inches thick. The subsoil is mottled and 18 inches thick. The upper part is dark yellowish-brown, friable loam. The next part is yellowish-brown, firm clay loam. The lower part is brown, firm silty clay loam. The underlying material is mottled light brownish-gray loam.

Conover soils have a high available water capacity. Permeability is moderate or moderately slow.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Conover loam, 0 to 4 percent slopes, 800 feet east and 780 feet south of the northwest corner of SE¼ sec. 29, T. 2 S., R. 4 E., in a cultivated area:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate, fine, granular structure; friable; less than 5 percent pebbles and cobbles; many fine roots; slightly acid; abrupt, smooth boundary.

B1—9 to 11 inches, dark yellowish-brown (10YR 4/4) loam;

common, medium, distinct, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; less than 5 percent pebbles and cobbles; common fine roots; slightly acid; clear, wavy boundary.

B21t—11 to 19 inches, yellowish-brown (10YR 5/4) clay loam; common, fine, distinct, grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; continuous, thin, dark grayish-brown (10YR 4/2) clay films on faces of peds and in pores; less than 5 percent pebbles and cobbles; few fine roots; slightly acid; gradual, wavy boundary.

B22t—19 to 27 inches, brown (7.5YR 4/4) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) and gray (10YR 6/1) mottles; moderate, medium, subangular blocky structure; firm; continuous, thin, dark grayish-brown (10YR 4/2) clay films on faces of peds and in pores; less than 5 percent pebbles and cobbles; few fine roots; slightly acid; gradual, wavy boundary.

C1g—27 to 50 inches, light brownish-gray (10YR 6/2) loam; common, medium, distinct, yellowish-brown (10YR 5/4) and common, medium, faint, gray (10YR 6/1) mottles; weak, medium, subangular blocky structure; firm; 5 percent pebbles and cobbles; slight effervescence; mildly alkaline; gradual, wavy boundary.

C2g—50 to 60 inches, light brownish-gray (10YR 6/2) loam; common, medium, distinct, strong-brown (7.5YR 5/6) and common, medium, faint, gray (10YR 6/1) mottles; massive; firm; 5 percent pebbles and cobbles; slight effervescence; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness, which coincides with depth to effervescent material. The solum ranges from medium acid to neutral. Pebbles and cobbles range from 3 percent to 10 percent throughout the profile.

The Ap horizon is very dark grayish-brown (10YR 3/2), very dark gray (10YR 3/1), or very dark brown (10YR 2/2) loam or sandy loam. The A2 horizon, if present, is pale-brown (10YR 6/3), grayish-brown (10YR 5/2), or brown (10YR 5/3) loam or sandy loam.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. The B1 horizon is mottled in many pedons. It is loam or clay loam. The B2t horizon is heavy loam, clay loam, or silty clay loam. It is mottled. A B3 horizon occurs in some pedons. It is loam or light clay loam and is mottled.

The C horizon is light brownish gray (10YR 6/2), pale brown (10YR 6/3), brown (10YR 5/3), dark grayish brown (10YR 4/2), or grayish brown (10YR 5/2) and is mottled.

The Conover soils are generally near Miami, Kidder, and Brookston soils in most landscapes. They are more gray in the subsoil than the Miami and Kidder soils, and they have less sand in the surface layer and underlying material than the Kidder soils. They are less gray in the subsoil than the Brookston soils.

CoB—Conover loam, 0 to 4 percent slopes. This soil is in broad areas and along drainageways of till plains and moraines. Slopes in the broad areas are complex. Areas are irregular in shape and range from 5 to 380 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are some small areas of Metamora sandy loam, Miami loam, Brookston loam, Blount loam, and moderately well drained soils. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols.

This soil has a seasonal high water table and is subject to ponding in the nearly level areas. Runoff is slow or very slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIe–4 (2.5b); woodland group 2o4; woody plant group 2; recreation group 9.

CpA—Conover-Brookston loams, 0 to 2 percent slopes. This mapping unit is in depressional areas, in low-lying areas, and along drainageways of till plains and moraines. Areas are irregular in shape and range from 5 to more than 100 acres in size. Conover soils make up about 50 percent of the acreage, and Brookston soils make up about 25 percent.

Included with this unit in mapping are small areas of Metamora sandy loam, Miami loam, Pewamo clay loam, and Blount loam. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

This unit has a high water table and is too wet for crop production unless drained. Runoff is very slow. Depressional areas are subject to flooding by runoff from higher areas.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIw–4 (2.5b and 2.5c); Conover soil in woodland group 2o4, woody plant group 2, recreation group 9; Brookston soil in woodland group 2w1, woody plant group 5, recreation group 7.

Dixboro Series

The Dixboro series consists of somewhat poorly drained, nearly level and gently sloping soils. They formed in stratified deposits of alternating layers of sandy and loamy textured sediments on lake plains and outwash plains.

In a representative profile the surface layer is very dark grayish-brown fine sandy loam 9 inches thick. The subsurface layer is mottled, pale-brown fine sandy loam 2 inches thick. The subsoil is mottled and is 17 inches thick. The upper part is brown, friable heavy fine sandy loam. The middle part is brown, friable fine sandy loam. The lower part is light yellowish-brown, very friable loamy fine sand. The underlying material is mottled, light yellowish-brown, stratified silt loam, fine sandy loam, very fine sandy loam, and fine sand.

Dixboro soils have a moderate available water capacity. Permeability is moderate. Most of the acreage is used for crops. Some small areas are in woodland or vegetable production.

The Dixboro soils in this county are mapped only with Kibbie soils.

Representative profile of Dixboro fine sandy loam, 0 to 4 percent slopes, 660 feet south and 85 feet east of the northwest corner sec. 14, T. 4 S., R. 7 E., in a cultivated area of Dixboro-Kibbie fine sandy loams:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak, medium, subangular blocky structure parting to moderate, fine, granular; friable; many fine roots; neutral; abrupt, smooth boundary.

A2—9 to 11 inches, pale-brown (10YR 6/3) fine sandy loam; common, medium, prominent, yellowish-red (5YR 5/8) mottles; moderate, thin and medium, platy structure; very friable; few very dark grayish-brown (10YR 3/2) worm casts; few very fine roots; neutral; abrupt, wavy boundary.

B21t—11 to 18 inches, brown (10YR 5/3) heavy fine sandy loam; many, medium, distinct, yellowish-brown

(10YR 5/6, 5/8), few, medium, prominent, yellowish-red (5YR 5/8), and common, medium, faint, grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; friable; few very fine roots; neutral; clear, wavy boundary.

B22t—18 to 23 inches, brown (10YR 5/3) fine sandy loam; common, medium, faint, grayish-brown (10YR 5/2), many, medium, distinct, yellowish-brown (10YR 5/6, 5/8), and few, medium, prominent, yellowish-red (5YR 5/8) mottles; moderate, medium, subangular blocky structure; friable; common, thin clay films on vertical faces of peds; few very fine roots; neutral; clear, wavy boundary.

B3—23 to 28 inches, light yellowish-brown (10YR 6/4) loamy fine sand; many, medium, distinct, yellowish-brown (10YR 5/6, 5/8), grayish-brown (10YR 5/2), and few, medium, prominent, yellowish-red (5YR 5/8) mottles; weak, coarse, subangular blocky structure; very friable; few very fine roots; slight effervescence in lower part; mildly alkaline; abrupt, wavy boundary.

C—28 to 60 inches, light yellowish-brown (10YR 6/4) stratified silt loam, fine sandy loam, very fine sandy loam and fine sand; many, coarse, distinct, yellowish-brown (10YR 5/6, 5/8) and common, coarse, distinct, grayish-brown (10YR 5/2) mottles; massive; friable and very friable; common, light-gray (10YR 6/1) calcium carbonate segregations in silt loam strata; violent effervescence; mildly alkaline.

The solum ranges from 24 to 44 inches in thickness. The upper part is medium acid to neutral and the lower part is slightly acid to mildly alkaline.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It is fine sandy loam, very fine sandy loam, loamy fine sand, or loamy very fine sand. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is mottled and has texture like the Ap horizon. In uncultivated areas the A1 horizon is black (10YR 2/1) or very dark brown (10YR 2/2), and the A2 horizon is near maximum thickness. The A1 horizon has texture like that of the Ap horizon.

The B2t horizon has hue of 10YR or 7.5YR and value and chroma of 3 to 6. It is mottled. It is fine sandy loam, loam, silt loam, or very fine sandy loam. The B3 horizon has colors like those of the B2t horizons. It is fine sandy loam, silt loam, loamy fine sand, loamy very fine sand, or very fine sandy loam. Thin strata of sand, silty clay loam, or silty clay are in some pedons.

The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 1 to 4, and it is mottled. It is stratified silt loam, fine sandy loam, very fine sandy loam, fine sand, or very fine sand. Some pedons have thin strata of sand, silty clay loam, or silty clay.

The Dixboro soils are generally near Kibbie, Lamson, and Sisson soils in most landscapes. They have less clay in the subsoil than the Sisson and Kibbie soils. They are less gray in the subsoil than the Lamson soils.

DoA—Dixboro-Kibbie fine sandy loams, 0 to 4 percent slopes. This mapping unit is in low-lying areas and along drainageways of lake plains and outwash plains. Areas are irregular in shape and range from about 10 to 300 acres in size.

Dixboro soils make up about 45 percent of the acreage, and Kidder soils make up about 35 percent. The Dixboro soils have the profile described as representative of the Dixboro series.

Included with these soils in mapping are small areas of Colwood loam, Lamson fine sandy loam, and Wasepi sandy loam. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols.

Most of the soils in this unit have a seasonal high water table. Runoff is slow or very slow. These soils have a tendency to plug drainage tile and are unstable in stream banks and open drain banks.

Most of the acreage is used for crops. Some small areas are in woodland or vegetable production. Capability unit IIw–5 (3b and 2.5b); woodland group 2o4; woody plant group 2; recreation group 16.

Edwards Series

The Edwards series consists of very poorly drained, nearly level soils formed in organic deposits overlying marl. These soils are on outwash plains, lake plains, till plains, and moraines.

In a representative profile the upper layer is black muck 32 inches thick. The underlying material is light-gray marl.

Edwards soils have a very high available water capacity. Permeability is rapid in the organic material and variable in the marl.

Most of the acreage is used for wildlife and woodland. Some areas are used for crops, truck crops, or permanent pasture.

Representative profile of Edwards muck, 440 feet north and 370 feet east of the southwest corner of NW¼ sec. 18, T. 3 S., R. 4 E., in a cultivated area:

Oa1—0 to 9 inches, black (10YR 2/1, broken face and rubbed) sapric material; moderate, fine, granular structure; friable; 5 percent fiber; sodium pyrophosphate very dark grayish brown (10YR 3/2); many fine roots; mildly alkaline; abrupt, smooth boundary.

Oa2—9 to 15 inches, black (10YR 2/1, broken face), very dark brown (10YR 2/2, rubbed) sapric material; weak, thick, platy structure; friable; 10 percent fiber, less than 5 percent rubbed; sodium pyrophosphate very dark grayish brown (10YR 3/2); common fine roots; mildly alkaline; clear, smooth boundary.

Oa3—15 to 32 inches, black (10YR 2/1, broken face and rubbed) sapric material; weak, thick, platy structure; friable; 15 percent fiber, 5 percent rubbed; sodium pyrophosphate very dark grayish brown (10YR 3/2); few, fine roots; slight effervescence; mildly alkaline; clear, smooth boundary.

Lca—32 to 60 inches, light-gray (10YR 7/1) marl; massive; friable; strong effervescence; mildly alkaline.

Depth to the Lca horizon ranges from 16 to 49 inches. The organic material ranges from slightly acid to mildly alkaline, but reaction is commonly mildly alkaline throughout. The organic material is derived primarily from herbaceous plants. Some pedons are 10 to 20 percent, by volume, coarse fragments. These are twigs, branches, or logs within the organic material; however, individual layers within some pedons have a single log, which occupies most of the layer.

The surface layer is very dark brown (10YR 2/2) or black (10YR 2/1, N 2/0, broken face and rubbed). Rubbed fiber content is less than 10 percent. The next layers of organic material have hue of 10YR, 7.5YR or 5YR, value of 2 or 3, and chroma of 0, 1, or 3 on the broken face and rubbed. Thin layers of more fibrous material occur in some pedons; these have a combined thickness of less than 5 inches. Small shells are in the organic material near the marl contact and occur throughout in some pedons.

The Lca horizon has hue of 10YR, value of 5 to 8, and chroma of 1 or 2. The thickness of the marl is more than 6 inches.

The Edwards soils are generally near Adrian, Houghton, and Palms soils in most landscapes. They are underlain by marl, unlike the Adrian soils, which are underlain by sand, and the Palms soils, which are underlain by loam. They have a thinner organic layer than the Houghton soils.

Ed—Edwards muck. This soil is in depressional areas, in low-lying areas, and along waterways of outwash

plains, lake plains, till plains, and moraines. Slope is 0 to 2 percent. Areas are irregular in shape and range from 3 to about 200 acres in size.

Included with this soil in mapping are small areas of Houghton muck, Palms muck, Adrian muck, and Edwards muck, shallow variant.

This soil is too wet for crop production unless drained. It has a high water table and is subject to flooding. If cleared and drained, it is subject to soil blowing, subsidence, burning, and frost damage. Runoff is very slow.

Most of the acreage is used for wildlife and woodland. Some areas are used for crops, truck crops, or permanent pasture. Capability unit IVw–2 (M/mc); woodland group 4w2; woody plant group 1; recreation group 1.

Edwards Variant

The Edwards variant consists of very poorly drained, nearly level soils formed in shallow and very shallow organic deposits overlying marl. These soils are on outwash plains, lake plains, till plains, and moraines.

In a representative profile the surface layer is black muck 9 inches thick. The underlying material is light-gray and gray marl.

The Edwards variant has a variable available water capacity. Permeability is rapid in the organic material and variable in the marl.

Most of the acreage is used for wildlife and woodland. Drained areas are used for crops, truck crops, or permanent pasture.

Representative profile of Edwards muck, shallow variant, 1,000 feet north and 210 feet east of the southwest corner sec. 18, T. 3 S., R. 4 E., in a cultivated area:

Oa1—0 to 9 inches, black (10YR 2/1) sapric material; moderate, fine, granular structure; friable; less than 1 percent fiber; 25 percent silt; few light-gray (10YR 7/1) shells; violent effervescence; moderately alkaline; abrupt, smooth boundary.

Lca1—9 to 15 inches, light-gray (10YR 7/1) and gray (10YR 6/1) marl; massive; friable; violent effervescence; moderately alkaline; gradual, wavy boundary.

Lca2—15 to 35 inches, gray (10YR 5/1) marl; massive; friable; 3 inch layer of black (N 2/0) sapric material; few shell fragments; violent effervescence; moderately alkaline; gradual, wavy boundary.

Lca3—35 to 60 inches, light-gray (10YR 7/2) marl; massive; friable; violent effervescence; moderately alkaline.

Depth to the Lca horizon ranges from 4 to 16 inches. Reaction is neutral to moderately alkaline.

The organic material is very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), black (10YR 2/1, N 2/0), or dark reddish brown (5YR 2/2). The colors change slightly if the soil is rubbed. Fiber content ranges from less than 1 percent to 10 percent. Shells and shell fragments are in some pedons.

The Lca horizon is light gray (10YR 7/1, 7/2), gray (10YR 6/1, 5/1), and dark gray (10YR 4/1). In some pedons thin layers of organic material are in the Lca horizon.

The Edwards variant soils are generally near Palms, Adrian, and Houghton soils in most landscapes. They have a thinner organic layer than those soils.

Ee—Edwards muck, shallow variant. This soil is in depressional areas, in low-lying areas, and along waterways and lakes of outwash plains, lake plains, till plains, and moraines. Slope is 0 to 2 percent. Areas are irregular in shape and range from 3 to about 40 acres in size.

Included with this soil in mapping are small areas of Edwards muck, Houghton muck, Adrian muck, and Sebewa loam. Also included are some small areas of soils that have marl exposed on the surface.

This soil is too wet for crop production unless drained. It has a high water table and is subject to flooding. If cleared and drained, it is subject to soil blowing, subsidence, burning, and frost damage. Runoff is very slow. Because this soil is alkaline, some fertility elements can become unavailable.

Most of the acreage is used for wildlife and woodland. Drained areas are used for crops, truck crops, or permanent pasture. Capability unit IVw–2 (M/mc); woodland group 4w2; woody plant group 1; recreation group 1.

Fill Land

Fd—Fill land consists of areas filled with 3 to more than 5 feet of soil material. Slopes are less than 6 percent in most areas. Areas are irregular in shape and range from 3 to more than 40 acres in size.

The soil material ranges from sand to clay. Many of the areas were poorly drained and very poorly drained before they were filled, and present drainage is variable.

Included with this soil in mapping were some small areas of Made land and unfilled poorly drained soils.

Fill land has variable available water capacity and permeability. Runoff is medium to very slow.

Most of the acreage is used for recreation, industry, and residential developments. Fill land requires onsite investigation prior to use. It has not been assigned to a capability unit, woodland group, woody plant group, or recreation group.

Fox Series

The Fox series consists of well-drained, nearly level to steep soils formed in loamy textured and sandy textured gravelly sand. These soils are on outwash plains, kames, valley trains, terraces, and moraines.

In a representative profile the surface layer is dark grayish-brown sandy loam 10 inches thick. The subsurface layer is pale-brown sandy loam 4 inches thick. The subsoil is 25 inches thick. The upper part is dark yellowish-brown, very friable gravelly sandy loam. The next part is dark-brown friable gravelly sandy clay loam. The lower part is dark-brown, firm gravelly clay loam. The underlying material is pale-brown gravelly sand.

Fox soils have a moderate available water capacity. Permeability is moderate.

Most of the acreage is used for crops. Some small areas are under urban development, are used for woodland, permanent pasture, or wildlife, or are mined for sand and gravel.

Representative profile of Fox sandy loam, 2 to 6 percent slopes, 495 feet north and 578 feet east of the southwest corner of NW¼ sec. 32, T. 2 S., R. 5 E., in a cultivated area:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, fine, granular structure; very fri-

able; 10 percent pebbles; slightly acid; abrupt, smooth boundary.

A2—10 to 14 inches, pale-brown (10YR 6/3) sandy loam; weak, medium, granular structure; very friable; 11 percent pebbles; slightly acid; clear, wavy boundary.

B1—14 to 22 inches, dark yellowish-brown (10YR 4/4) gravelly sandy loam; weak, fine, subangular blocky structure; very friable; 20 percent pebbles; slightly acid; gradual, wavy boundary.

B21t—22 to 31 inches, dark-brown (7.5YR 4/4) gravelly sandy clay loam; weak, medium, subangular blocky structure; friable; many, thicker clay films on all faces of peds; 24 percent pebbles; neutral; gradual, wavy boundary.

B22t—31 to 39 inches, dark-brown (7.5YR 4/4) gravelly clay loam; few, fine, faint, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; firm; common, moderately thick clay films on all faces of peds; 15 percent pebbles; neutral; abrupt irregular boundary.

IIC—39 to 60 inches, pale-brown (10YR 6/3) gravelly sand; single grained; loose; 29 percent pebbles; slight effervescence; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness, which coincides with depth to effervescent material. The upper part is medium acid to slightly acid, and the lower part of the solum is neutral or mildly alkaline. Pebbles range from 5 percent to 30 percent in the solum and from 15 percent to 60 percent in the underlying material.

The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 4/3, 3/3), or very dark grayish brown (10YR 3/2) moist. The A2 horizon, if present, is pale brown (10YR 6/3) or brown (10YR 5/3, 4/3). In uncultivated areas the A1 horizon is very dark grayish-brown (10YR 3/2) or dark-brown (10YR 3/3) sandy loam, and the A2 horizon is near maximum thickness.

The B1 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is gravelly sandy loam, sandy loam, loam, or sandy clay loam. A B1 horizon is not present in all pedons. The B2t horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 3 to 6. It is sandy clay loam, clay loam, heavy sandy loam, or the gravelly counterparts. A B3 horizon which has colors like those of the B2t horizon, occurs in some pedons. It is sandy loam, sandy clay loam, or loamy sand and is gravelly in many pedons.

The IIC horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. This soil is more than 45 percent fine sand and coarse sand and more gravel than is typical for the series. This does not significantly influence use and management.

The Fox soils are generally near Matherton, Sebewa, Boyer, and Kendallville soils in most landscapes. They lack the gray color in the subsoil characteristic of the Matherton and Sebewa soils. They have more clay in the subsoil than the Boyer soils. They have more sand and less clay in the underlying material than the Kendallville soils.

FoA—Fox sandy loam, 0 to 2 percent slopes. This soil is in broad upland areas of outwash plains, kames, valley trains, terraces, and moraines. Areas range from 3 to about 700 acres in size. This soil has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are small areas of Matherton sandy loam, Sebewa loam, Boyer loamy sand, and Fox cobbly sandy loam, cobbly variant. Some small areas of poorly drained soils, steeper soils, and soils that have a cobbly surface are identified on the soil map by spot symbols.

This soil is slightly droughty. Runoff is slow.

Most of the acreage is used for crops. Some small areas are under urban development, are used for woodland, or are mined for sand and gravel. Capability unit IIs–1 (3a); woodland group 1o1; woody plant group 4; recreation group 10.

FoB—Fox sandy loam, 2 to 6 percent slopes. This soil is in upland areas and on outwash plains, kames, valley trains, terraces, and moraines. Slopes are uniform or short and complex. Areas are irregular in shape and range from 3 to about 250 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Matherton sandy loam, Boyer loamy sand, Kendallville loam, Miami loam, Sebewa loam, and Fox cobbly sandy loam, cobbly variant. Some small areas of poorly drained soils, steeper soils, depressions, and soils that have a cobbly surface are identified on the soil map by spot symbols. Small areas of nearly level soil are also included.

The hazard of erosion is moderate, and this soil is slightly droughty. Runoff is slow.

Most of the acreage is used for crops. Some small areas are under urban development, are used for woodland, or are mined for sand and gravel. Capability unit IIe–3 (3a); woodland group 1o1; woody plant group 4; recreation group 11.

FoC—Fox sandy loam, 6 to 12 percent slopes. This soil is on outwash plains, kames, valley trains, terraces, and moraines. Slopes are uniform or short and complex. Areas are irregular in shape and range from 3 to about 120 acreas in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is slightly less. In cultivated areas the pale-brown subsurface layer and some dark yellowish-brown subsoil are incorporated into the surface layer.

Included with this soil in mapping are small areas of Matherton sandy loam, Boyer loamy sand, Kendallville loam, Miami loam, and Fox cobbly sandy loam, cobbly variant. Small areas of soils that are less than 24 inches deep over the underlying gravelly sand are also included. Some small areas of poorly drained soils, very poorly drained soils, steeper soils, depressions, and soils that have a cobbly surface are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

The hazard of erosion is moderate. This soil is also slightly droughty. Runoff is medium. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops. Some small areas are under urban development, are used for woodland, or are mined for sand and gravel. Capability unit IIIe–6 (3a); woodland group 1o1; woody plant group 4; recreation group 12.

FoD—Fox sandy loam, 12 to 18 percent slopes. This soil is in pitted outwash areas and along streams and drainageways of outwash plains, kames, valley trains, terraces, and moraines. Most areas are irregular in shape, but some are long and narrow. They range from 3 to about 60 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is about 1 foot less. In cultivated areas the pale-brown subsurface layer and some dark yellowish-brown subsoil are incorporated into the surface layer.

Included with this soil in mapping are small areas of Kendallville loam, Boyer loamy sand, Miami loam, Matherton sandy loam, and Fox cobbly sandy loam, cobbly

Figure 6.—Typical area of Fox sandy loam, 12 to 18 percent slopes. Convex steeper area in center is a good source of gravel.

variant. Many small areas of severely eroded soils that are less than 24 inches deep over the underlying gravelly sand are also included. Some small areas of wet depressional soils, steeper soils, depressions, and soils that have a cobbly surface are identified on the soil map by spot symbols. Small areas of sloping soils are also included.

The hazard of erosion is severe and the soil is slightly droughty. Runoff is medium. Complex slopes make tillage difficult.

Most of the acreage is used for crops. Some small areas are under urban development, are used for woodland or permanent pasture, or are mined for sand and gravel (fig. 6). Capability unit IVe–2 (3a); woodland group 1o1; woody plant group 4; recreation group 13.

FoE—Fox sandy loam, 18 to 25 percent slopes. This soil is in pitted outwash areas and along major streams and drainageways of outwash plains, kames, valley trains, terraces, and moraines. Most areas are irregular in shape, but some are long and narrow. They range from 3 to 110 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is about 1 foot less. Many areas also have a thinner, darker colored surface layer.

Included with this soil in mapping are small areas of Miami loam, Boyer loamy sand, Kidder sandy loam, and Fox cobbly sandy loam, cobbly variant. Many small areas of severely eroded soils that are less than 24 inches deep over the underlying gravelly sand are also included. Some small areas of wet depressional soils and soils that have a cobbly surface are identified on the soil map by spot symbols. Small areas of moderately steep and very steep soils are also included.

The hazard of erosion is very severe, and this soil is slightly droughty. Runoff is rapid.

Most of the acreage is used for recreation, woodland, and wildlife. Some small areas are used for permanent pasture or are mined for sand and gravel. Capability unit VIe–2 (3a); woodland group 1r1; woody plant group 4; recreation group 13.

Fox Variant

The Fox variant consists of well-drained, nearly level to moderately steep soils formed in loamy textured gravelly and cobbly deposits underlain by gravelly sand (fig. 7). These soils are on outwash plains, valley trains, terraces, and moraines.

In a representative profile the surface layer is dark grayish-brown cobbly sandy loam 8 inches thick. The subsoil is dark-brown, firm cobbly clay loam 19 inches thick. The underlying material is pale-brown gravelly sand.

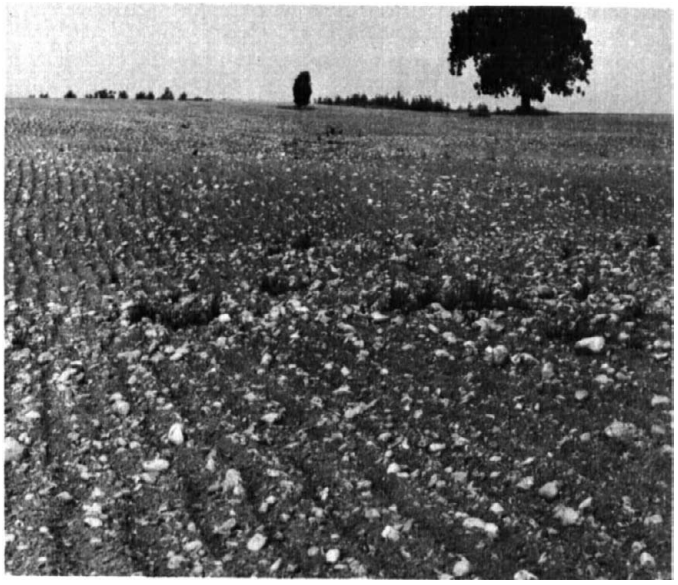

Figure 7.—**Cobblestones and pebbles in cultivated area of Fox cobbly sandy loam, cobbly variant, 2 to 6 percent slopes.**

Fox variant soils have a low available water capacity. Permeability is moderate in the solum and rapid in the underlying material.

Most of the acreage is used for crops. Some areas are used for woodland or permanent pasture, or are mined for sand, gravel, and cobblestones.

Representative profile of Fox cobbly sandy loam, cobbly variant, 6 to 12 percent slopes, 500 feet south and 1,000 feet east of the northwest corner of SE¼ sec. 35, T. 3 S., R. 3 E., in a cultivated area:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) cobbly sandy loam; weak, fine, subangular blocky structure; friable; 20 percent pebbles, 17 percent cobblestones; neutral; abrupt, smooth boundary.

B2t—8 to 27 inches, dark-brown (7.5YR 4/4) cobbly clay loam; strong, fine, subangular blocky structure; firm; continuous, thick clay films on faces of peds, pebbles, and cobbles; 25 percent cobbles, 17 percent pebbles; neutral; clear, wavy boundary.

IIC—27 to 60 inches, pale-brown (10YR 6/3) gravelly sand; single grained; loose; 40 percent pebbles; 30 percent cobbles; strong effervescence; mildly alkaline.

The solum ranges from 20 to 40 inches in thickness, which coincides with depth to effervescent material. The solum ranges from medium acid to neutral. The surface layer ranges from 15 percent to 40 percent pebbles and cobbles. The subsoil and underlying material range from 35 percent to 75 percent pebbles and cobbles.

The Ap horizon is dark grayish-brown (10YR 4/2) or dark-brown (10YR 4/3) cobbly sandy loam or cobbly loam. In some places a pale-brown (10YR 6/3), brown (10YR 5/3), or yellowish-brown (10YR 5/4) A2 horizon is present.

The B2t horizon is dark-brown (7.5YR 4/4), strong-brown (7.5YR 5/6), dark reddish-brown (5YR 3/4), reddish-brown (5YR 4/4), or dark yellowish-brown (10YR 3/4, 4/4) cobbly or gravelly sandy loam, sandy clay loam, or clay loam. A B3 horizon, if present, has colors like those of the B2t horizon. It is cobbly or gravelly sand, loamy sand, or sandy loam.

The IIC horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4.

Fox variant soils are generally near Fox and Boyer soils in most landscapes. Fox variant soils contain more pebbles and cobbles than the Fox and Boyer soils.

FpB—Fox cobbly sandy loam, cobbly variant, 2 to 6 percent slopes. This soil is in broad upland areas and on outwash plains, valley trains, terraces, and moraines. Slopes are long and uniform or short and complex. Areas are irregular in shape and range from 3 to more than 200 acres in size.

This soil has a profile similar to the one described as representative of the variant, but the subsoil is thicker. Included with this soil in mapping are many small areas of Fox sandy loam. Some small areas of Boyer loamy sand and Oshtemo loamy sand, and small areas of soils that have less than 15 percent cobbles in the surface layer are also included. Some small areas of poorly drained soils, steeper soils, and depressions are identified on the soil map by spot symbols.

This Fox cobbly variant is droughty. Runoff is slow or very slow. The cobblestones make tillage difficult.

Most of the acreage is used for crops. Some small areas are used for woodland or are mined for sand, gravel, and cobblestones. Capability unit IIIs–1 (Ga); woodland group 2f3; woody plant group 4; recreation group 14.

FpC—Fox cobbly sandy loam, cobbly variant, 6 to 12 percent slopes. This soil is on outwash plains, valley trains, terraces, and moraines. Slopes are uniform or short and complex. Areas are irregular in shape and range from 3 to 100 acres in size. This soil has the profile described as representative of the variant.

Included with this soil in mapping are many small areas of Fox sandy loam and some small areas of Boyer loamy sand and Oshtemo loamy sand. Small areas of soils that are less than 20 inches deep over the underlying gravelly sand, and small areas of soils that have less than 15 percent cobbles in the surface layer are also included. Some small areas of poorly drained soils, very poorly drained soils, steeper soils, and depressions are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

The hazard of erosion is moderate and the soil is droughty. Runoff is medium. Complex slopes and the cobblestones make tillage difficult.

Most of the acreage is used for crops. Some areas are used for woodland. Some are mined for sand, gravel, and cobblestones. Capability unit IIIe–3 (Ga); woodland group 2f3; woody plant group 4; recreation group 15.

FpD–Fox cobbly sandy loam, cobbly variant, 12 to 18 percent slopes. This soil is in pitted outwash areas and along streams and drainageways on outwash plains, valley trains, terraces, and moraines. Areas are irregular in shape and range from 3 to more than 50 acres in size.

This soil has a profile similar to the one described as representative of the variant, but depth to the underlying material is slightly less. In cultivated areas some of the dark-brown subsoil is incorporated into the surface layer.

Included with this soil in mapping are small areas of Fox sandy loam, Boyer loamy sand, and Kidder sandy loam. Many small areas of severely eroded soils that are less than 20 inches deep over the underlying gravelly sand are also included. Some small areas of wet depressional soils, steeper soils, and depressions are identified on the soil map by spot symbols. Small areas of sloping soils are also included.

The hazard of erosion is severe, and the soil is

droughty. Runoff is rapid. Complex slopes and the cobblestones make tillage difficult.

Most of the acreage is used for permanent pasture or hay. Some areas are used for crops or woodland, or are mined for sand, gravel, and cobblestones. Capability unit IVe–3 (Ga); woodland group 2f3; woody plant group 4; recreation group 15.

Gilford Series

The Gilford series consists of very poorly drained, nearly level soils formed in loamy and sandy deposits underlain by gravelly sand. These soils are on outwash plains, valley trains, deltas, and lake plains.

In a representative profile the surface layer is black sandy loam 11 inches thick. The subsoil is friable and dark grayish brown and is 17 inches thick. The upper part is sandy loam, and the lower part is light sandy loam. The underlying material is gray gravelly sand.

Gilford soils have a low available water capacity. Permeability is moderately rapid.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Gilford sandy loam, 65 feet east and 600 feet south of the northwest corner sec. 2, T. 4 S., R. 7 E., in a cultivated area:

Ap—0 to 11 inches, black (10YR 2/1) sandy loam; weak, fine, granular structure; very friable; 2 percent fine pebbles; neutral; abrupt, smooth boundary.

B21g—11 to 15 inches, dark grayish-brown (2.5Y 4/2) sandy loam; moderate, medium, subangular blocky structure; friable; 4 percent fine pebbles; neutral; clear, smooth boundary.

B22g—15 to 22 inches, dark grayish-brown (2.5Y 4/2) sandy loam; moderate, medium, subangular blocky structure; friable; 10 percent fine pebbles; neutral; clear, smooth boundary.

B3g—22 to 28 inches, dark grayish-brown (2.5Y 4/2) light sandy loam; weak, medium, subangular blocky structure; friable; 10 percent fine pebbles; neutral; clear, wavy boundary.

IICg—28 to 60 inches, gray (5Y 5/1) gravelly sand; single grained; loose; 20 percent pebbles; slight effervescence; mildly alkaline.

The solum ranges from 26 to 40 inches in thickness. It is slightly acid or neutral. Pebble content ranges from less than 1 percent to 10 percent throughout the solum.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), or dark brown (10YR 3/3).

The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. In some pedons the lower part is mottled. Layers of loamy sand or sandy clay loam ranging from 1 to 10 inches in thickness are in some pedons.

The IICg horizon has hue of 10YR, 2.5Y or 5Y, value of 4 to 7, and chroma of 1. It is commonly gravelly sand but ranges to sand. Thin strata of silt, sandy loam, or clay loam are in the IICg horizon of some pedons.

Gilford soils are generally near Wasepi, Thetford, Sebewa, and Wauseon soils. They are more gray in the subsoil than the Wasepi and Thetford soils. They have less clay in the subsoil than the Sebewa soils. They have more sand and less clay in the underlying material than the Wauseon soils.

Gf—Gilford sandy loam. This soil is in depressional areas, broad low-lying areas, and drainageways of outwash plains, valley trains, and lake plains. Slope is 0 to 2 percent. Areas are irregular in shape and range from 3 to about 320 acres in size.

Included with this soil in mapping are small areas of Wasepi sandy loam, Thetford loamy fine sand, Sebewa loam, Adrian muck, Wauseon fine sandy loam, and Granby fine sand. Some small areas of organic soils are identified on the soil map by a spot symbol.

This soil has a high water table and is too wet for crop production unless drained. If cleared and drained, it has a tendency to be droughty during the summer. Runoff is very slow. Depressional areas are subject to flooding by runoff from adjacent areas.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIIw–1 (4c); woodland group 3w1; woody plant group 5; recreation group 7.

Granby Series

The Granby series consists of poorly drained and very poorly drained, nearly level soils formed in sandy textured glaciofluvial or lacustrine deposits. These soils are on outwash plains and lake plains.

In a representative profile (fig. 8) the surface layer is very dark gray fine sand 11 inches thick. The subsoil is loose fine sand 27 inches thick. The upper part is grayish brown. The next part is mottled grayish brown. The lower part is mottled light gray. The underlying

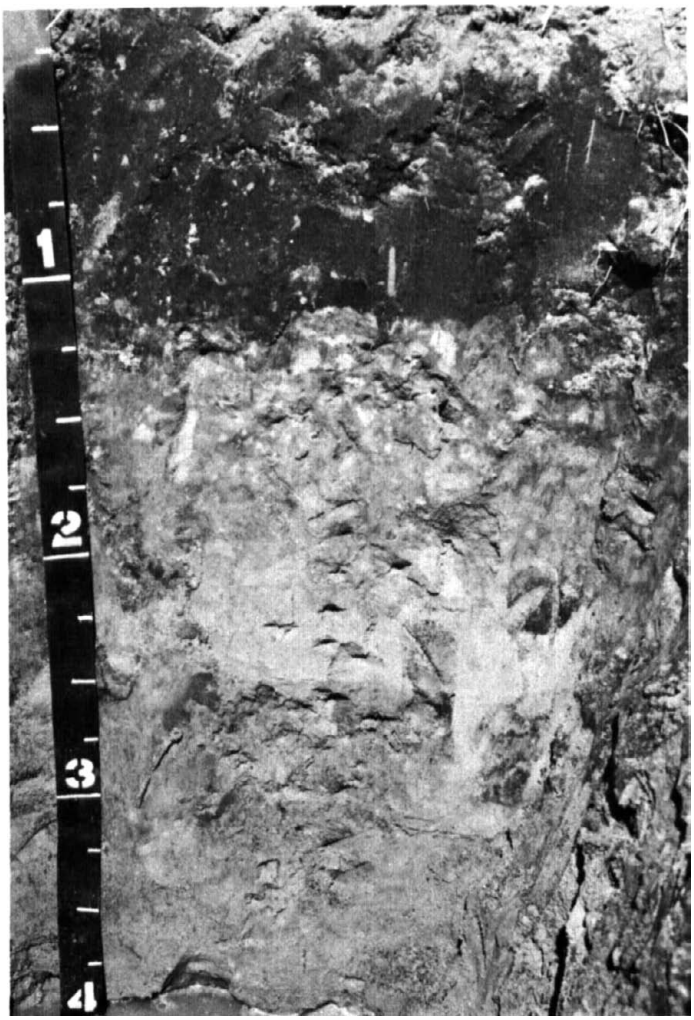

Figure 8.—**Profile of Granby fine sand. Depth is marked in feet.**

material is mottled dark grayish-brown and light brownish-gray fine sand.

Granby soils have a low available water capacity. Permeability is rapid.

Most of the acreage is used for crops. Some small areas are in woodland.

A representative profile of Granby fine sand, 1,335 feet west and 1,295 feet south of the northeast corner sec. 36, T. 4 S., R. 7 E., in a cultivated area:

Ap—0 to 11 inches, very dark gray (10YR 3/1) fine sand, gray (10YR 5/1) dry; moderate, medium, granular structure; very friable; many fine roots; neutral; abrupt, smooth boundary.

B21g—11 to 17 inches, grayish-brown (10YR 5/2) fine sand; single grained; loose; few fine roots; neutral; gradual, wavy boundary.

B22g—17 to 25 inches, grayish-brown (10YR 5/2) fine sand; few, fine, faint, light-gray (10YR 7/2) mottles; single grained; loose; few fine roots; neutral; gradual, wavy boundary.

B3g—25 to 38 inches, light-gray (10YR 7/2) fine sand; common, medium, distinct, gray (10YR 5/1) mottles; single grained; loose; very few fine roots; neutral; clear, wavy boundary.

C1g—38 to 43 inches, dark grayish-brown (10YR 4/2) fine sand; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; single grained; loose; neutral; clear, wavy boundary.

C2g—43 to 60 inches, light brownish-gray (10YR 6/2) fine sand; few, fine, distinct gray (10YR 5/1) mottles; single grained; loose; mildly alkaline.

The solum ranges from 28 to 52 inches in thickness. It is slightly acid to mildly alkaline.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is fine sand, loamy sand, or loamy fine sand.

The Bg horizon has hue of 10YR, value of 4 to 7, and chroma of 1 or 2 and is mottled. It is sand, fine sand, or loamy fine sand.

The Cg horizon has colors like those of the B horizon and is sand or fine sand.

The Granby soils are generally near Oakville, Tedrow, Gilford, and Lamson soils in most landscapes. They are more gray in the subsoil than the Tedrow soils. They have more sand in the subsoil than the Gilford and Lamson soils. The gray in the subsoil that is characteristic of the Granby soils is not present in the Oakville soils.

Gr—Granby fine sand. This soil is in wet depressional areas, broad low-lying areas, and drainageways of outwash areas. Slope is 0 to 2 percent. Areas are irregular in shape and range from 3 to 250 acres in size.

Included with this soil in mapping are small areas of Tedrow loamy fine sand, Thetford loamy fine sand, Gilford sandy loam, Adrian muck, and Lamson fine sandy loam. Some small areas of organic soils are identified on the soil map by a spot symbol.

This soil has a high water table and is too wet for crop production unless drained. If cleared and drained, it is subject to soil blowing and has a tendency to be droughty during the summer. Runoff is very slow. Depressional areas are subject to flooding by runoff from adjacent areas.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIIw–1 (5c); woodland group 5w1; woody plant group 5; recreation group 7.

Houghton Series

The Houghton series consists of very poorly drained, nearly level soils formed in organic deposits. These soils are in areas of lake plains, outwash plains, till plains, and moraines.

In a representative profile the surface layer is very dark muck 7 inches thick. The next layer is black muck 15 inches thick. Below this is 28 inches of very dark brown muck. The lower layer is dark-brown and very dark brown muck.

Houghton soils have a very high available water capacity. Permeability is rapid.

Most of the acreage is used for woodland and wildlife. Some small areas are in crops and permanent pasture.

Representative profile of Houghton muck, 825 feet east and 60 feet south of the northwest corner of the NE¼ sec. 33, T. 2 S., R. 5 E., in an uncultivated area:

Oa1—0 to 7 inches, very dark brown (10YR 2/2, broken face), black (10YR 2/1, rubbed), sapric material; moderate, medium, granular structure; friable; 7 percent fiber, less than 5 percent rubbed; neutral; clear, smooth boundary.

Oa2—7 to 22 inches, black (10YR 2/1) sapric material; moderate, medium, subangular blocky structure; friable; 10 percent fiber, less than 5 percent rubbed; neutral; clear, smooth boundary.

Oa3—22 to 34 inches, very dark brown (10YR 2/2, broken face), black (10YR 2/1, rubbed) sapric material; weak, thick, platy structure; friable; less than 5 percent fiber; neutral; gradual, smooth boundary.

Oa4—34 to 50 inches, very dark brown (10YR 2/2) sapric material; weak, thick, platy structure; friable; 10 percent fiber, less than 5 percent rubbed; neutral; clear, smooth boundary.

Oa5—50 to 60 inches, dark-brown (7.5YR 3/2, broken face) and very dark brown (10YR 2/2, broken face), very dark brown (10YR 2/2, rubbed) sapric material; weak, thick, platy structure; friable; less than 5 percent fiber; neutral.

The organic material is more than 51 inches thick. It is derived mainly from herbaceous plants. Some pedons contain woody fragments. Fiber content in the upper part is commonly less than 5 percent when rubbed, but it ranges to 10 percent. Fiber content in the lower part is commonly less than 10 percent. In the lower part of some pedons there is a layer of hemic material less than 10 inches or there is a layer of fibric less than 5 inches thick. The organic material has hue of 10YR, 7.5YR, or 5YR, value of 2 or 3, and chroma of 0 to 3.

Houghton soils are generally near Palms, Adrian, and Edwards soils in most landscapes. They have a thicker organic layer than those soils.

Hn—Houghton muck. This soil is in depressional areas, in broad low-lying areas, and along waterways of lake plains, outwash plains, till plains, and moraines. Areas are irregular in shape and range from 3 to more than 200 acres in size.

Included with this soil in mapping are small areas of Palms muck, Adrian muck, and Edwards muck. Some areas of marsh are identified on the soil map by spot symbols.

This soil is too wet for crop production unless drained. It has a high water table and is subject to flooding. In cleared and drained areas, it is subject to soil blowing, subsidence, burning, and frost damage. Runoff is very slow.

Most of the acreage is used for woodland and wildlife. Some small areas are in crops and permanent pasture. Capability unit IIIw–3 (Mc); woodland group 4w2; woody plant group 1; recreation group 1.

Hoytville Series

The Hoytville series consists of very poorly drained,

nearly level soils formed in clayey textured glacial till. These soils are on areas of till plains and lake plains.

In a representative profile the surface layer is silty clay loam 9 inches thick. The upper part is very dark grayish brown and the lower part is very dark gray. The subsoil is very firm mottled clay 34 inches thick. The upper part is dark gray and the lower part is gray. The underlying material is mottled grayish-brown clay.

Hoytville soils have a moderate available water capacity. Permeability is slow.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Hoytville silty clay loam, 1,245 feet west and 50 feet north of the southeast corner of the NE¼ sec. 24, T. 4 S., R. 6 E., in a cultivated area:

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate, fine, subangular blocky structure; firm; 2 percent fine pebbles; neutral; abrupt, smooth boundary.

A12—6 to 9 inches, very dark gray (10YR 3/1) heavy silty clay loam; strong, medium, angular blocky structure; firm; 2 percent fine pebbles; neutral; clear, smooth boundary.

B21tg—9 to 14 inches, dark-gray (10YR 4/1) clay; common, fine, prominent, yellowish-brown (10YR 5/6, 5/8) mottles; strong, fine, angular blocky structure; very firm; many, thin clay films on faces of peds; 2 percent fine pebbles; neutral; clear, smooth boundary.

B22tg—14 to 31 inches, gray (10YR 5/1) clay; common, medium, prominent, yellowish-brown (10YR 5/6, 5/8) mottles; moderate, coarse, prismatic structure parting to strong, medium, angular blocky; very firm; many thin clay films on faces of peds; 2 percent fine pebbles; mildly alkaline; gradual, smooth boundary.

B3g—31 to 43 inches, gray (10YR 5/1) clay; many, medium, prominent, yellowish-brown (10YR 5/6, 5/8) mottles; moderate, medium, angular blocky structure; very firm; 2 percent fine pebbles; mildly alkaline; gradual, wavy boundary.

Cg—43 to 60 inches, grayish-brown (10YR 5/2) clay; many, medium, prominent, yellowish-brown (10YR 5/6, 5/8) mottles; massive; firm; 5 percent pebbles; slight effervescence; moderately alkaline.

The solum ranges from 36 to 45 inches in thickness, which coincides with depth to effervescent material. Pebbles and cobbles range from 2 percent to 8 percent throughout the profile. The solum is slightly acid to mildly alkaline.

The A horizon is very dark gray (10YR 3/1), very dark grayish-brown (10YR 3/2), or black (10YR 2/1) silty clay loam or clay loam.

The Bg horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2 and is mottled. It is clay or silty clay.

The Cg horizon is gray (10YR 5/1) or grayish brown (10YR 5/2) and is mottled. It is silty clay or clay.

Hoytville soils are generally near St. Clair, Nappanee, and Wauseon soils in most landscapes. They are gray in the subsoil, whereas the St. Clair soils are mostly brown. They are more gray in the subsoil than the Nappanee soils. They have less sand and more clay in the subsoil than the Wauseon soils.

Ho—Hoytville silty clay loam. This nearly level soil is in depressional areas, broad low-lying areas, and drainageways of till plains and lake plains. Slope is 0 to 2 percent. Areas are irregular in shape and range from 3 to about 700 acres in size.

Included with this soil in mapping are small areas of Pewamo clay loam, Palms muck, and Nappanee silty clay loam. Some small areas of Wauseon fine sandy loam and of organic soils are included and are identified on the soil map by spot symbols. Small areas of soils that are less than 36 inches deep over the underlying clay are also included.

This soil has a high water table and is too wet for crop production unless drained. Runoff is very slow. Depressional areas are subject to flooding by runoff from adjacent areas.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIw–2 (1c); woodland group 2w1; woody plant group 5; recreation group 7.

Kendallville Series

The Kendallville series consists of well-drained, gently sloping and sloping soils formed in a thin layer of loamy gravelly outwash underlain by loamy textured glacial till. These soils are on moraines and till plains.

In a representative profile the surface layer is dark grayish-brown loam 10 inches thick. The subsoil is 28 inches thick. The upper part is dark yellowish-brown, friable loam. The next part is dark reddish-brown, firm gravelly clay loam. The lower part is dark yellowish-brown, friable gravelly loamy sand. The underlying material is yellowish-brown loam.

Kendallville soils have a high available water capacity. Permeability is moderately slow.

Most of the acreage is used for crops. Some small areas are in woodland or are under urban development.

Representative profile of Kendallville loam, 2 to 6 percent slopes, 700 feet south and 400 feet east of the northwest corner of NE¼ sec 36, T. 3 S., R. 5 E., in a cultivated area:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) loam; moderate, medium, granular structure; friable; 3 percent pebbles; slightly acid; abrupt, smooth boundary.

B1—10 to 20 inches, dark yellowish-brown (10YR 4/4) loam; moderate, medium, subangular blocky structure; friable; 8 percent pebbles; slightly acid; clear, wavy boundary.

B2t—20 to 34 inches, dark reddish-brown (5YR 3/4) gravelly clay loam; moderate, medium, subangular blocky structure; firm; 20 percent pebbles; thick clay films on faces of peds; neutral; clear, wavy boundary.

B3—34 to 38 inches, dark yellowish-brown (10YR 3/4) gravelly loamy sand; weak, fine, granular structure; friable; 25 percent pebbles; mildly alkaline; abrupt, irregular boundary.

IIC—38 to 60 inches, yellowish-brown (10YR 5/4) loam; massive; friable; 3 percent pebbles; strong effervescence; mildly alkaline.

The solum is 25 to 40 inches thick. The depth to effervescent material ranges from 20 to 38 inches. The solum is medium acid to mildly alkaline. Pebble content ranges from less than 1 percent to 30 percent in the solum and from 2 percent to 15 percent in the underlying material.

The Ap horizon is dark grayish-brown (10YR 4/2) or brown (10YR 4/3) loam or sandy loam. The A2 horizon, if present, is pale brown (10YR 6/3) or brown (10YR 5/3) and has texture like that of the Ap horizon. In uncultivated areas the A1 horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2) and has texture like that of the Ap horizon, and the A2 horizon is near maximum thickness.

The B horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 4 to 6. The B1 horizon is loam or sandy loam. The B2t horizon is clay loam, sandy clay loam, gravelly clay loam, or gravelly sandy clay loam. In most pedons a B3 horizon is present. It is gravelly loamy sand or sandy loam.

The IIC horizon is yellowish-brown (10YR 5/4), brown (10YR 5/3), or dark yellowish-brown (10YR 4/4) loam or clay loam.

The Kendallville soils are generally near Miami, Fox, and Macomb soils in most landscapes. They have more coarse sand and gravel in the subsoil than the Miami soils. They have less sand and more clay in the underlying material than the Fox soils. They lack gray color in the subsoil characteristic of the Macomb soils.

KeB—Kendallville loam, 2 to 6 percent slopes. This soil is in broad upland areas and on low rises and side slopes of moraines and till plains. Areas are irregular in shape and range from 3 to about 100 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Fox sandy loam, Miami loam, Owosso sandy loam, Macomb loam, and Morley loam. Small areas of moderately well drained soils, poorly drained soils, steeper soils, and nearly level soils are also included. Soils that have a cobbly surface are identified on the soil map by spot symbols.

The hazard of erosion is slight. Runoff is slow.

Most of the acreage is used for crops. Some small areas are in woodland or are under urban development. Capability unit IIe–2 (3/2a); woodland group 1o1; woody plant group 4; recreation group 11.

KeC—Kendallville loam, 6 to 12 percent slopes. This soil is in broad areas and along streams and drainageways of moraines and till plains. Slopes in the broad areas are complex. Areas are irregular in shape and range from 3 to about 80 acres in size.

This soil has a profile similar to the one that is described as representative of the series, but depth to the underlying material is slightly less. In cultivated areas, some dark yellowish-brown subsoil is incorporated into the surface layer.

Included with this soil in mapping are small areas of Fox sandy loam, Miami loam, Owosso sandy loam, Macomb loam, and Morley loam. Some small areas of poorly drained soils, very poorly drained soils, steeper soils, and soils that have a cobbly surface are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

The hazard of erosion is moderate. Runoff is medium. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops. Some small areas are in woodland or are under urban development. Capability unit IIIe–5 (3/2a); woodland group 1o1; woody plant group 4; recreation group 12.

Kibbie Series

The Kibbie series consists of somewhat poorly drained, nearly level and gently sloping soils formed in stratified deposits that have alternating layers of sandy to loamy textured sediments. These soils are on lake plains, deltas, and outwash plains.

In a representative profile the surface layer is very dark grayish-brown fine sandy loam 9 inches thick. The subsurface layer is mottled pale-brown fine sandy loam 3 inches thick. The subsoil is firm, mottled, and brown and is 17 inches thick. The upper part is sandy clay loam, and the lower part is silty clay loam. The underlying material is mottled pale-brown stratified fine sand, very fine sand, and silt.

Kibbie soils have a high available water capacity. Permeability is moderate.

Most of the acreage is used for crops. Some small areas are used for vegetable production or woodland.

Representative profile of Kibbie fine sandy loam, 0 to 4 percent slopes, 1,000 feet north and 600 feet east of the southwest corner of the NE¼ sec. 7, T. 4 S., R. 7 E., in a cultivated area:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate, medium, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2—9 to 12 inches, pale-brown (10YR 6/3) fine sandy loam; few, fine, faint, grayish-brown (10YR 5/2) and few, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, granular structure; friable; slightly acid; clear, wavy boundary.

B21t—12 to 21 inches, brown (10YR 4/3) sandy clay loam; common, medium, faint, brown (10YR 5/3) and grayish-brown (10YR 5/2) and common, medium, prominent, yellowish-brown (10YR 5/6, 5/8) mottles; moderate, medium, subangular blocky structure; firm; many thin clay films on faces of peds; slightly acid; clear, wavy boundary.

B22t—21 to 29 inches, brown (10YR 5/3) silty clay loam; common, medium, faint, grayish-brown (10YR 5/2) and common, medium, prominent, yellowish-brown (10YR 5/6, 5/8) mottles; moderate, medium, subangular blocky structure; firm; many thin clay films on faces of peds; neutral; abrupt, wavy boundary.

C—29 to 60 inches, pale-brown (10YR 6/3) stratified fine sand, very fine sand, and silt; common, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6, 5/8) mottles; massive; friable; violent effervescence; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness, which coincides with depth to effervescent material. The solum is slightly acid or neutral. Pebbles are less than 1 percent throughout the solum.

The Ap horizon is very dark grayish-brown (10YR 3/2) or dark-brown (10YR 2/2) fine sandy loam or loam. The A2 horizon is pale brown (10YR 6/3) or brown (10YR 5/3, 4/3) and is mottled. It has texture like that of the Ap horizon. In uncultivated areas the A1 horizon is very dark grayish brown (10YR 3/2) or black (10YR 2/1) and has texture like that of the Ap horizon. The A2 horizon is near maximum thickness.

The B horizon is yellowish brown (10YR 5/4, 5/6), pale brown (10YR 6/3), and brown (10YR 4/3, 5/3) and is mottled. It is sandy clay loam, silty clay loam, loam, silt loam, or clay loam. Thin strata of silt, fine sand, and very fine sand are in some pedons.

The C horizon is light grayish brown (10YR 6/2), pale brown (10YR 6/3), light yellowish brown (10YR 6/4), or yellowish brown (10YR 5/4, 5/6), and is mottled. It is stratified silt loam, very fine sandy loam, fine sand, silt, very fine sand, silty clay loam, and loamy very fine sand.

Kibbie soils are generally near Sisson, Dixboro, Pella, and Colwood soils in most landscapes. They are gray in the subsoil, whereas the Sisson soils are brown. They have more clay in the subsoil than the Dixboro soils. They are less gray in the subsoil than the Colwood and Pella soils.

KnA—Kibbie fine sandy loam, 0 to 4 percent slopes. This soil is in depressional areas, in broad low-lying areas, and along drainageways of lake plains and outwash plains. Areas are irregular in shape and range from 5 to about 80 acres in size.

Included with this soil in mapping are some small areas of Pella silt loam, Colwood loam, Dixboro fine sandy loam, and Sisson fine sandy loam. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols.

This soil has a seasonal high water table and is subject to ponding in nearly level areas. Runoff is slow or

very slow. This soil has a tendency to plug drainage tile and is unstable in stream and open drain banks.

Most of the acreage is used for crops. Some small areas are used for vegetable production or woodland. Capability unit IIw–5 (2.5b); woodland group 2o4; woody plant group 2; recreation group 16.

Kidder Series

The Kidder series consists of well-drained, gently sloping to very steep soils formed in loamy textured glacial till. These soils are on till plains and moraines.

In a representative profile the surface layer is dark grayish-brown sandy loam 8 inches thick. The subsurface layer is pale-brown sandy loam 5 inches thick. The subsoil is 23 inches thick. The upper part is brown, friable sandy clay loam. The lower part is yellowish-brown, firm clay loam. The underlying material is pale-brown sandy loam.

Kidder soils have a moderate available water capacity. Permeability is moderate. These soils are well suited to woodland wildlife, openland wildlife, and to woodland. Gently sloping areas are well suited to crops. Sloping areas and moderately steep areas are suited to crops if erosion is controlled.

Most of the acreage is used for crops. Some areas are in woodland or permanent pasture.

Representative profile of Kidder sandy loam, 2 to 6 percent slopes, 850 feet south and 400 feet east of the northwest corner of SW¼ sec. 31, T. 2 S., R. 5 E., in a cultivated area:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) sandy loam; moderate, fine, granular structure; friable; 5 percent pebbles and cobbles; slightly acid; abrupt, smooth boundary.

A2—8 to 13 inches, pale-brown (10YR 6/3) sandy loam; moderate, medium, granular structure; friable; 5 percent pebbles and cobbles; slightly acid; clear, wavy boundary.

B21t—13 to 26 inches, brown (10YR 5/3) sandy clay loam; moderate, medium, subangular blocky structure; friable; many, thin, brown (7.5YR 5/4) clay films on faces of peds; 5 percent pebbles and cobbles; slightly acid; gradual, wavy boundary.

B22t—26 to 36 inches, yellowish-brown (10YR 5/4) clay loam; moderate, medium, subangular blocky structure; firm; common, thick, brown (7.5YR 4/4) clay films on faces of peds and in root channels; 5 percent pebbles and cobbles; slightly acid; abrupt, wavy boundary.

C—36 to 60 inches, pale-brown (10YR 6/3) sandy loam; weak, medium, subangular blocky structure becoming massive as depth increases; friable; 7 percent pebbles and cobbles; strong effervescence; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness, which coincides with depth to effervescent material. The solum is generally slightly acid but ranges from medium acid to mildly alkaline. Pebbles and cobbles range from 3 percent to 15 percent throughout the profile.

The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 4/3), or very dark grayish brown (10YR 3/2) moist. In most places an A2 horizon is present. It has a hue of 10YR, value of 5 or 6, and chroma of 2 to 4. In uncultivated areas the A1 horizon is grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2), and the A2 horizon is near maximum thickness.

The B1 horizon, if present, is brown (10YR 4/3, 5/3), yellowish-brown (10YR 5/4, 5/6), or dark yellowish-brown (10YR 4/4) sandy loam. The B2t horizon has hue of 10YR, 7.5YR and value and chroma of 3 to 5. It is sandy clay loam, clay loam, loam, or heavy sandy loam. In some places a B3 horizon is present. It has colors intermediate between the B2t and C horizons. It is sandy loam or light sandy clay loam.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6.

The Kidder soils are generally near Miami, Conover, and Riddles soils in most landscapes. Kidder soils have more sand in the surface layer and underlying material than the Miami and Conover soils. They have a thinner solum than the Riddles soils.

KrB–Kidder sandy loam, 2 to 6 percent slopes. This soil is in broad upland areas and on low rises and side slopes of till plains and moraines. Areas are irregular in shape and range from 3 to about 100 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Miami loam, Riddles sandy loam, Owosso sandy loam, and Conover loam. Some small areas of poorly drained soils, steeper soils, and depressions are identified on the soil map by spot symbols. Small areas of nearly level soils are also included.

The hazard of erosion is slight. Runoff is slow.

Most of the acreage is used for crops. Some areas are in woodland. Capability unit IIe–2 (2.5a); woodland group 1o1; woody plant group 4; recreation group 11.

KrC—Kidder sandy loam, 6 to 12 percent slopes. This soil is in broad areas and along streams and drainageways of till plains and moraines. Slopes in the broad areas are short and complex. Areas are irregular in shape and range from 3 to more than 100 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is slightly less. The subsurface layer and some brown subsoil are incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Riddles sandy loam, Miami loam, Owosso sandy loam, and Conover loam. Some small areas of poorly drained soils, very poorly drained soils, steeper soils, depressions, and soils that have a cobbly surface are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

The hazard of erosion is moderate. Runoff is medium. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops. Some areas are in woodland. Capability unit IIIe–5 (2.5a); woodland group 1o1; woody plant group 4; recreation group 12.

KrD—Kidder sandy loam, 12 to 18 percent slopes. This soil is in broad areas and along streams and drainageways of till plains and moraines. Slopes in the broad areas are short and complex. Areas are irregular or elongated in shape and range from 3 to more than 100 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is significantly less. The subsurface layer and some brown subsoil material are incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Miami loam, Boyer loamy sand, Spinks loamy sand, and Riddles sandy loam. Many small areas of severely eroded soils that are less than 24 inches over the underlying material are also included. Some small areas of wet depressional soils, steeper soils, depressions, and soils that have a cobbly surface are identified on the soil

map by spot symbols. Small areas of sloping soils are also included.

The hazard of erosion is severe. Runoff is rapid. Complex slopes make tillage difficult.

This soil is used for woodland, crops, and permanent pasture. Capability unit IVe–2 (2.5a); woodland group 1o1; woody plant group 4; recreation group 13.

Lamson Series

The Lamson series consists of poorly drained and very poorly drained, nearly level soils formed in stratified deposits that have alternating layers of sandy to loamy textured sediments. These soils are on lake plains and outwash plains.

In a representative profile the surface layer is very dark brown fine sandy loam 9 inches thick. The subsurface layer is 4 inches of mottled grayish-brown loamy very fine sand. The subsoil is mottled and is 19 inches thick. The upper part is grayish-brown, very friable fine sandy loam. The lower part is pale-brown, friable fine sandy loam. The underlying material is mottled pale-brown, stratified fine sandy loam, very fine sand, and silt loam.

Lamson soils have a moderate available water capacity. Permeability is moderate. Most of the acreage is used for crops. Some small areas are in woodland.

The Lamson soils in this county are mapped only with Colwood soils.

Representative profile of Lamson fine sandy loam, in an area of Lamson-Colwood complex, 225 feet south and 60 feet east of the northwest corner of the SW¼ sec. 35, T. 4 S., R. 7 E., in a cultivated area:

Ap—0 to 9 inches, very dark brown (10YR 2/2) fine sandy loam; moderate, medium, crumb structure; very friable; neutral; abrupt, smooth boundary.

A2g—9 to 13 inches, grayish-brown (10YR 5/2) loamy very fine sand; few, fine, prominent, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; very friable; neutral; clear, wavy boundary.

B21g—13 to 22 inches, grayish-brown (10YR 5/2) fine sandy loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; very friable; mildly alkaline; gradual, smooth boundary.

B22g—22 to 32 inches, pale-brown (10YR 6/3) fine sandy loam; many, medium, prominent, yellowish-brown (10YR 5/6, 5/8) mottles; weak, medium, subangular blocky structure; friable; light brownish-gray (10YR 6/2) coatings on faces of peds; mildly alkaline; gradual, wavy boundary.

C—32 to 60 inches, pale-brown (10YR 6/3) stratified fine sandy loam, very fine sand and silt loam; common, medium, prominent, yellowish-brown (10YR 5/6) mottles; massive; friable; strong effervescence; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness. It is slightly acid to mildly alkaline.

The Ap horizon is very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), or very dark gray (10YR 3/1). The A2g horizon is grayish brown (10YR 5/2), light brownish gray (10YR 6/2), or gray (10YR 6/1) and is mottled in many places. It is fine sandy loam or loamy very fine sand.

The B2g horizon is gray (10YR 6/1, 5/1), grayish brown (10YR 5/2), brown (7.5YR 4/4, 10YR 5/4), pale brown (10YR 6/3), or light brownish gray (10YR 6/2) and is mottled. It is fine sandy loam or loamy very fine sand. In some places a B3 horizon is present. It is gray (10YR 6/1), light brownish gray (10YR 6/2), or pale brown (10YR 6/3) and is mottled. It is fine sandy loam or loamy very fine sand.

The C horizon is light brownish gray (10YR 6/2), pale brown (10YR 6/3), or gray (10YR 6/1, 5/1) and is mottled. It is stratified fine sandy loam, very fine sand, and silt loam and has some thin clayey layers.

The Lamson soils in most landscapes are near the Dixboro, Colwood, and Granby soils. Lamson soils are more gray in the subsoil than the Dixboro soils. They have less clay in the subsoil than the Colwood soils. Lamson soils have silt and clay in the subsoil, whereas the Granby soils are sandy in the subsoil.

Ln—Lamson-Colwood complex. This mapping unit is in broad low-lying areas and in drainageways on lake plains and outwash plains. Slope is 0 to 2 percent. Areas are irregular in shape and range from about 5 to 400 acres in size. Lamson fine sandy loam makes up about 35 percent of the acreage, and Colwood loam about 25 percent.

Included with these soils in mapping are small areas of Kibbie fine sandy loam, Dixboro fine sandy loam, Granby fine sand, Wauseon fine sandy loam, Adrian muck, and Thetford loamy fine sand. Some small areas of organic soils are identified on the soil map by a spot symbol.

Most of the soils in this mapping unit have a high water table and are too wet for crop production unless drained. Runoff is very slow. Depressional areas are subject to flooding by runoff from adjacent areas. These soils have a tendency to plug drainage tile and are unstable in stream and open drain banks.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIw–5 (3c and 2.5c); woodland group 3w1; woody plant group 5; recreation group 7.

Macomb Series

The Macomb series consists of somewhat poorly drained, nearly level and gently sloping soils formed in a thin layer of loamy gravelly outwash underlain by loamy textured glacial till. These soils are on lake plains and till plains.

In a representative profile the surface layer is very dark grayish-brown loam 8 inches thick. The subsurface layer is 3 inches of mottled pale-brown loam. The subsoil is firm, mottled clay loam 18 inches thick. The upper part is brown and the lower part is pale brown. The upper 4 inches of the underlying material is mottled pale-brown gravelly sand and below that is mottled brown clay loam.

Macomb soils have a high available water capacity. Permeability is moderately slow.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Macomb loam, 0 to 4 percent slopes, 660 feet south and 430 feet west of the northeast corner of SE¼ sec. 35, T. 1 S., R. 5 E., in a cultivated area:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate, fine, granular structure; friable; many fine roots; 3 percent pebbles; slightly acid; abrupt, smooth boundary.

A2—8 to 11 inches, pale-brown (10YR 6/3) loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; common fine roots; 3 percent pebbles; slightly acid; clear, wavy boundary.

B21t—11 to 19 inches, brown (10YR 5/3) clay loam; common, medium, distinct, yellowish-brown (10YR 5/6)

mottles; moderate, medium, subangular blocky structure; firm; common fine roots; continuous brown (10YR 5/3) clay films on faces of peds and in pores; less than 5 percent pebbles; neutral; gradual, wavy boundary.

B22t—19 to 29 inches, pale-brown (10YR 6/3) clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) and gray (10YR 6/1) mottles; moderate, coarse, subangular blocky structure; firm; few fine roots; continuous grayish brown (10YR 5/2) clay films on faces of peds and in pores; 5 percent pebbles; neutral; abrupt, irregular boundary.

IIC1—29 to 33 inches, pale-brown (10YR 6/3) gravelly sand; common, medium, prominent, yellowish-brown (10YR 5/6) and gray (5Y 6/1) mottles; single grained; loose; 40 percent pebbles; slight effervescence; mildly alkaline; abrupt, smooth boundary.

IIIC2—33 to 60 inches, brown (10YR 5/3) clay loam; common, medium, prominent gray (5Y 6/1) mottles; massive; firm; 5 percent pebbles; slight effervescence; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness, which coincides with depth to effervescent material. The solum is medium acid to neutral. Pebbles range from 3 to 20 percent in the solum, 20 to 40 percent in the IIC1 horizon and 3 to 10 percent in the IIC2 horizon.

The Ap horizon is very dark grayish-brown (10YR 3/2) or very dark brown (10YR 2/2) sandy loam, fine sandy loam, or loam. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3 and is mottled. It has texture like that of the Ap horizon and ranges from 3 to 6 inches in thickness. In uncultivated areas the A1 horizon has color and texture like those of the Ap horizon and the A2 horizon is near maximum thickness.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3, 4, or 6 and is mottled. It is clay loam, gravelly clay loam, sandy clay loam, gravelly sandy clay loam, heavy loam, or loam.

The C horizon consists of two layers. The upper part is pale brown (10YR 6/3) or light yellowish brown (10YR 6/4) and is mottled. It is gravelly sand, gravelly loamy sand, or gravelly sandy loam. The lower part is brown (10YR 5/3) or yellowish brown (10YR 5/4, 5/6) and is mottled. It is clay loam, loam, or silty clay loam.

The Macomb soils are generally near Kendallville, Matherton, and Metamora soils in most landscapes. Macomb soils differ from the Kendallville soils in having gray color in the subsoil. They have more silt and clay in the underlying material within a depth of 40 inches than the Matherton soils. They contain more pebbles than the Metamora soils.

MaA—Macomb loam, 0 to 4 percent slopes. This soil is in broad low-lying areas and along drainageways of lake plains and till plains. Areas are irregular in shape and range from 3 to 60 acres in size.

Included with this soil in mapping are small areas of Kendallville loam, Matherton sandy loam, Metamora sandy loam, Blount loam, and Conover loam. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols.

This soil has a seasonal high water table and is subject to ponding in nearly level areas. Runoff is slow or very slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIe–4 (3/2b); woodland group 2o4; woody plant group 2; recreation group 9.

Made Land

Mb—Made land. This land type consists of areas filled with such nonsoil material as municipal garbage and rubble from demolition of roads and buildings. Slope is less than 6 percent in most areas. Areas are irregular in shape and range from 3 to 80 acres in size.

Most areas have been excavated to or below the permanent water table and then filled with alternate layers of refuse and soil material. The soil material ranges from sand to clay. Included with this land type in mapping are some small areas of fill land and areas that have not yet been filled.

The available water capacity, drainage, and permeability are variable. Runoff is slow or very slow.

Some areas are being filled. Some are used for recreation. Made land requires onsite investigation before use. It has not been placed in a capability unit, woodland group, woody plant group, or recreation group.

Matherton Series

The Matherton series consists of somewhat poorly drained, nearly level and gently sloping soils formed in loamy textured gravelly deposits underlain by sandy or gravelly materials. These soils are on outwash plains, valley trains, and terraces.

In a representative profile the surface layer is very dark brown sandy loam 9 inches thick. The subsoil is firm and is 23 inches thick. The upper part is mottled dark grayish-brown sandy clay loam. The lower part is mottled dark grayish-brown gravelly sandy clay loam. The underlying material is mottled grayish-brown sand.

Matherton soils have a moderate available water capacity. Permeability is moderate in the solum and rapid in the underlying material.

Most of the acreage is used for crops. Some small areas are in woodland or are mined for sand and gravel.

Representative profile of Matherton sandy loam, 0 to 4 percent slopes, 1,300 feet east and 600 feet south of the northwest corner of NE¼ sec. 31, T. 2 S., R. 5 E., in a cultivated area:

Ap—0 to 9 inches, very dark brown (10YR 2/2) sandy loam; moderate, medium, granular structure; friable; 5 percent pebbles; medium acid; abrupt, smooth boundary.

B21t—9 to 18 inches, dark grayish-brown (2.5Y 4/2) sandy clay loam; many, medium, distinct, yellowish-brown (10YR 5/6, 5/8) and olive-brown (2.5Y 4/4) mottles; moderate, medium, subangular blocky structure; firm; common, moderately thick, grayish-brown (10YR 5/2) clay films on faces of peds; 10 percent pebbles; medium acid; gradual, wavy boundary.

B22tg—18 to 32 inches, dark grayish-brown (2.5Y 4/2) gravelly sandy clay loam; common, medium, distinct, olive-brown (2.5Y 4/4), yellowish-brown (10YR 5/6, 5/8), and gray (5Y 6/1) mottles; weak, medium, subangular blocky structure; firm; common, moderately thick, light brownish-gray (10YR 6/2) clay films on faces of peds; 20 percent pebbles; slightly acid; abrupt, irregular boundary.

IICg—32 to 60 inches, grayish-brown (2.5Y 5/2) sand; few, medium, prominent, yellowish-brown (10YR 5/6) mottles; single grained; loose; 10 percent pebbles; strong effervescence; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness, which coincides with depth to effervescent material. The solum is medium acid to neutral. Pebble content ranges from less than 1 percent to 20 percent throughout the solum, and from 5 to 60 percent in the underlying materials.

The Ap horizon is very dark brown (10YR 2/2), very dark grayish-brown (10YR 3/2), or very dark gray (10YR 3/1) loam or sandy loam. In some places an A2 horizon of grayish-brown (10YR 5/2) or light grayish-brown (10YR 6/2) loam or sandy loam is present. In uncultivated areas the A1 horizon is very dark gray (10YR 3/1) or black (10YR 2/1) loam or sandy loam, and the A2 horizon is near maximum thickness.

The B2t horizon is brown (10YR 5/3), grayish brown (10YR 5/2), or dark grayish brown (10YR 4/2, 2.5Y 4/2) and is mottled. It is clay loam, sandy clay loam, or heavy loam, or gravelly sandy clay loam, gravelly clay loam, or heavy loam.

The IIC horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2 and is mottled. It is gravelly sand or sand.

The Matherton soils are generally near Fox, Sebewa, Wasepi, and Macomb soils in most landscapes. They differ from the Fox soils in having gray color in the subsoil. They are less gray in the subsoil than the Sebewa soils and have more clay in the subsoil than the Wasepi soils. They have less silt and clay in the underlying material within a depth of 40 inches than the Macomb soils.

MdA—Matherton sandy loam, 0 to 4 percent slopes. This soil is in depressional areas, broad low-lying areas, and along drainageways of outwash plains, valley trains, and terraces. Areas are irregular in shape and range from 3 to about 200 acres in size.

Included with this soil in mapping are small areas of Fox sandy loam and Wasepi sandy loam. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols.

This soil has a seasonal high water table, and nearly level areas are subject to ponding. Runoff is slow or very slow.

Most of the acreage is used for crops. Some small areas are in woodland or are mined for sand and gravel. Capability unit IIw–5 (3b) ; woodland group 2o4; woody plant group 2; recreation group 16.

Metamora Series

The Metamora series consists of somewhat poorly drained, nearly level and gently sloping soils formed in a thin layer of sandy and loamy textured glaciofluvial deposits over loamy textured glacial till. These soils are on till plains and moraines.

In a representative profile the surface layer is very dark grayish-brown sandy loam 9 inches thick. The subsoil is 28 inches thick. The upper part is mottled pale-brown, friable sandy loam. The middle part is mottled grayish-brown, friable sandy loam. The lower part is mottled grayish-brown, firm light clay loam. The underlying material is mottled brown loam.

Metamora soils have a high available water capacity. Permeability is moderately rapid in the sandy loam upper layers and moderately slow in the loamy lower layers.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Metamora sandy loam, 0 to 4 percent slopes, 650 feet west of Pontiac Trail and 8 feet south of the line fence in the SE¼NE¼SE¼ sec. 19, T. 1 S., R. 7 E., in a cultivated area:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak, medium, granular structure; friable; many fine roots; slightly acid; abrupt, smooth boundary.

B1—9 to 21 inches, pale-brown (10YR 6/3) sandy loam; many, medium, distinct, reddish-brown (5YR 4/4), yellowish-brown (10YR 5/6), and grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; many fine roots; slightly acid; clear, wavy boundary.

B21g—21 to 30 inches, grayish-brown (10YR 5/2) sandy loam; many, medium, distinct, yellowish-brown (10YR 5/6) and gray (5Y 6/1) mottles; weak, medium, subangular blocky structure; friable; common fine roots; slightly acid; gradual, wavy boundary.

IIB22tg—30 to 37 inches, grayish-brown (10YR 5/2) light clay loam; many, medium, distinct, yellowish-brown (10YR 5/6, 5/8) and gray (5Y 6/1) mottles; moderate, medium, subangular blocky structure; firm; thin clay films; few fine roots; neutral; clear, wavy boundary.

IIC—37 to 60 inches, brown (10YR 5/3) loam; many, medium, distinct, yellowish-brown (10YR 5/4, 5/6) and gray (10YR 6/1) mottles; massive; friable; strong effervescence; moderately alkaline.

The solum ranges from 18 to 40 inches in thickness, which coincides with depth to effervescent material. The upper part of the B horizon is slightly acid to strongly acid, and the IIB horizon is slightly acid or neutral. Cobbles and pebbles range from less than 1 percent to 8 percent throughout the solum.

The Ap horizon is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), or very dark brown (10YR 2/2). In some pedons an A2 horizon is present. It is light brownish-gray (10YR 6/2) sandy loam or loamy sand. In uncultivated areas the A1 horizon is very dark gray (10YR 3/1), very dark brown (10YR 2/2), or black (10YR 2/1), and the A2 horizon is near maximum thickness. The upper part of the B horizon is pale-brown (10YR 6/3), brown (10YR 5/3), grayish-brown (10YR 5/2) (2.5Y 5/2), or yellowish-brown (10YR 5/4) sandy loam or loamy sand, and the lower part is heavy sandy loam, sandy clay loam, or loam. The IIBg horizon is grayish-brown (10YR 5/2), gray (10YR 5/1), or light brownish-gray (10YR 6/2) light clay loam, clay loam, silty clay loam, or sandy clay loam.

The IIC horizon is brown (10YR 5/3), grayish-brown (2.5Y–10YR 5/2), or light brownish-gray (10YR 6/2) loam, silty clay loam, or clay loam.

Metamora soils lack the dominant gray colors in the upper part of the B horizon that are typical of the Metamora series. This does not affect use and management.

The Metamora soils are generally near Owosso, Conover, Brookston, and Macomb soils in most landscapes. They differ from Owosso soils in having gray color in the subsoil. They have more sand and less clay in the upper part of the subsoil than the Conover and Brookston soils and are less gray in the subsoil than the Brookston soils. They contain fewer pebbles than the Macomb soils.

MfA—Metamora sandy loam, 0 to 4 percent slopes. This soil is in depressional areas, broad, low-lying areas, and along drainageways of till plains and moraines. Areas are irregular in shape and range from 3 to about 100 acres in size.

Included with this soil in mapping are many small areas of Conover loam and some small areas of Owosso sandy loam, Matherton sandy loam, and Macomb loam. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols. Small areas of soils that have slopes of 5 to 6 percent are also included.

This soil has a seasonal high water table, and nearly level areas are subject to ponding. Runoff is slow or very slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIw–3 (3/2b) ; woodland group 2o4; woody plant group 2; recreation group 9.

Miami Series

The Miami series consists of well-drained, gently sloping to very steep soils formed in loamy textured glacial till. These soils are on till plains and moraines.

In a representative profile the surface layer is dark grayish-brown loam 8 inches thick. The subsoil is 30 inches thick. The upper part is dark-brown, friable

loam. The middle part is dark yellowish-brown and yellowish-brown, firm clay loam. The lower part is dark yellowish-brown, friable loam. The underlying material is yellowish-brown loam.

Miami soils have a high available water capacity. Permeability is moderate or moderately slow.

Most of the acreage is used for crops. Some small areas are under urban development or are in woodland. Steeply sloping areas are used for woodland and wildlife.

Representative profile of Miami loam, 2 to 6 percent slopes, 900 feet west and 300 feet north of the southeast corner of SW¼ sec. 29, T. 2 S., R. 4 E., in a cultivated area:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loam; moderate, medium, granular structure; friable; 5 percent cobbles and pebbles; many, fine roots; slightly acid; abrupt, smooth boundary.

B1—8 to 11 inches, dark-brown (10YR 4/3) loam; weak, medium, subangular blocky structure; friable; 5 percent cobbles and pebbles; many fine roots; slightly acid; clear, wavy boundary.

B21t—11 to 22 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; many, thin, brown (7.5YR 4/4) clay films on faces of peds; 5 percent cobbles and pebbles; common fine roots; slightly acid; gradual, wavy, boundary.

B22t—22 to 30 inches, yellowish-brown (10YR 5/4) clay loam; moderate, medium, subangular blocky structure; firm; continuous, thick, dark-brown (7.5YR 4/4) clay films on faces of peds; 5 percent cobbles and pebbles; few, fine roots; slightly acid; gradual, wavy boundary.

B3—30 to 38 inches, dark yellowish-brown (10YR 4/4) loam; weak, coarse, subangular blocky structure; friable; common, thick, brown (7.5YR 4/4) clay films on faces of peds; 5 percent cobbles and pebbles; neutral; clear, wavy boundary.

C—38 to 60 inches, yellowish-brown (10YR 5/4) loam; weak, medium, subangular blocky structure; friable; 8 percent pebbles; 2 percent cobbles and stones; slight effervescence; mildly alkaline.

The solum ranges from 24 to 60 inches in thickness, which coincides with depth to effervescent material. The solum generally is slightly acid to strongly acid but ranges to neutral in the lower part. Cobbles, pebbles, and stones range from 3 percent to 15 percent throughout the profile.

The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 4/3), or very dark grayish brown (10YR 3/2) The A2 horizon, if present, is brown (10YR 5/3), yellowish-brown (10YR 5/4), pale-brown (10YR 6/3), or light yellowish-brown (10YR 6/4) loam. In uncultivated areas the A1 horizon is very dark grayish-brown (10YR 3/2) or dark grayish-brown (10YR 4/2) loam, and the A2 horizon is near maximum thickness

The B1 horizon is dark-brown or brown (10YR 4/3, 5/3), yellowish-brown (10YR 5/4, 5/6), or dark yellowish-brown (10YR 4/4) loam, clay loam, silt loam, or sandy loam. The B2t horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or silty clay loam. The B3 horizon is brown (10YR 5/3), yellowish-brown (10YR 5/4, 5/6, 5/8), or dark yellowish brown (10YR 4/4) loam or clay loam.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is loam or light clay loam.

The Miami soils are generally near Conover, Kidder, Kendallville, and Owosso soils in most landscapes. They lack the gray color in the subsoil that is characteristic of the Conover soils. They have less sand in the surface layer and underlying material than the Kidder soils. They have less coarse sand and gravel in the subsoil than the Kendallville soils, and they have less sand and more clay in the upper part of the subsoil than the Owosso soils.

MmB—Miami loam, 2 to 6 percent slopes. This soil is in broad upland areas and on low rises and side slopes. Areas are irregular in shape and range from 3 to over 1,500 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Morley loam, Owosso sandy loam, Conover loam, and Brookston loam. Small areas of moderately well drained soils and soils that are less than 24 inches deep over the underlying material are also included. Some small areas of poorly drained and steeper soils are identified on the soil map by spot symbols. Small areas of nearly level soils are also included.

The hazard of erosion is slight. Runoff is slow.

Most of the acreage is used for crops. Some small areas are under urban development or are in woodland. Capability unit IIe–2 (2.5a); woodland group 1o1; woody plant group 4; recreation group 11.

MmC—Miami loam, 6 to 12 percent slopes. This soil is in broad areas and along streams and drainageways of till plains and moraines. Slopes in the broad areas are short and complex. Areas are irregular in shape and range from 3 to over 300 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is slightly less. Some dark-brown subsoil is incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Morley loam, Owosso sandy loam, and Conover loam. Small areas of moderately well drained soils and soils that are less than 24 inches deep over the underlying material are also included. Some small areas of poorly drained, very poorly drained, and steeper soils are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

The hazard of erosion is moderate. Runoff is medium. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops. Some small areas are under urban development or are in woodland. Capability unit IIIe–5 (2.5a); woodland group 1o1; woody plant group 4; recreation group 12.

MmD—Miami loam, 12 to 18 percent slopes. This soil is in broad areas and along streams and drainageways on till plains and moraines. Slopes in the broad areas are short and complex. Areas are irregular in shape and range from 3 to about 100 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is less. Some dark-brown subsoil is incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Fox sandy loam, Conover loam, and Morley loam. Many small areas of severely eroded soils that are less than 24 inches deep over the underlying material are also included. Some small areas of wet depressional soils and steeper soils are identified on the soil map by spot symbols. Small areas of sloping soils are also included.

The hazard of erosion is severe. Runoff is rapid. Complex slopes make tillage difficult.

Most of the acreage is used for crops. Some small areas are in woodland or permanent pasture. Capability unit IVe–2 (2.5a); woodland group 1o1; woody plant group 4; recreation group 13.

MmE—Miami loam, 18 to 25 percent slopes. This soil is along streams and drainageways and in broad areas on till plains and moraines. Slopes in the broad areas are short and complex. Most of these areas are long

and narrow, but some are irregular in shape. They range from 3 to about 100 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is less. Many areas have a thinner, darker colored surface layer and a light-colored subsurface layer that are not characteristic of the soil described as typical.

Included with this soil in mapping are small areas of Fox sandy loam and Morley loam. Many small areas of severely eroded soils that are less than 24 inches deep over the underlying material are also included. Some small areas of wet depressional soils are identified on the soil map by spot symbols. Small areas of moderately steep and very steep soils are also included.

The hazard of erosion is very severe. Runoff is rapid.

Most of the acreage is used for woodland, permanent pasture, and wildlife. Capability unit VIe–1 (2.5a); woodland group 1r1; woody plant group 4; recreation group 13.

MmF—Miami loam, 25 to 35 percent slopes. This soil is along streams and drainageways and is in broad areas on till plains and moraines. Slopes in the broad areas are short and complex. Most of these areas are long and narrow, but some are irregular in shape. They range from 3 to about 75 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is significantly less. It has a thinner, darker colored surface layer and a light-colored subsurface layer that are not characteristic of the soil described as typical.

Included with this soil in mapping are small areas of Fox sandy loam, Kidder sandy loam, Boyer loamy sand, and Spinks loamy sand. Many small areas of severely eroded soils that are less than 24 inches deep over the underlying material are also included. Some small areas of wet depressional soils are identified on the soil map by spot symbols. Small areas of steep soils and soils that have slopes of more than 35 percent are also included.

The hazard of erosion is very severe. Runoff is very rapid.

Most of the acreage is used for woodland and wildlife. Capability unit VIIe–1 (2.5a); woodland group 1r1; woody plant group 4; recreation group 6.

Morley Series

The Morley series consists of well drained and moderately well drained, gently sloping to steep soils formed in loamy textured glacial till. These soils are on till plains and moraines.

In a representative profile the surface layer is dark grayish-brown loam 7 inches thick. The subsurface layer is 5 inches of yellowish-brown and pale-brown loam. The subsoil is firm, and is 20 inches thick. The upper part is dark yellowish-brown heavy clay loam. The middle part is yellowish-brown heavy clay loam. The lower part is brown clay loam. The underlying material is yellowish-brown clay loam.

Morley soils have a high available water capacity. Permeability is moderately slow or slow.

Most of the acreage is used for crops. Some small areas are under urban development or are in woodland. Steeply sloping areas are used for woodland, permanent pasture, and wildlife.

Representative profile of Morley loam, 2 to 6 percent slopes, 1,302 feet south and 45 feet east of the northwest corner sec. 23, T. 1 S., R. 5 E., in a cultivated area:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam; moderate, medium, crumb structure; friable; less than 2 percent pebbles and cobbles; many fine roots; neutral; abrupt, smooth boundary.

B&A—7 to 12 inches, yellowish-brown (10YR 5/4) interiors of the peds, pale-brown (10YR 6/3) coatings on peds and extending into some root channels; loam; moderate, medium, subangular blocky structure; friable; dark grayish-brown (10YR 4/2) coating around worm casts; less than 5 percent pebbles and cobbles; many fine roots; slightly acid; clear, irregular boundary.

B21t—12 to 20 inches, dark yellowish-brown (10YR 4/4) heavy clay loam; moderate, medium, angular blocky structure; firm; dark-brown (7.5YR 4/4) clay films on faces of peds; less than 5 percent cobbles and pebbles; few fine roots; medium acid; gradual, wavy boundary.

B22t—20 to 28 inches, yellowish-brown (10YR 5/4) heavy clay loam; moderate, medium, subangular blocky structure; firm; dark yellowish-brown (10YR 4/4) clay films on faces of peds; less than 5 percent cobbles and pebbles; few fine roots; medium acid; gradual, wavy boundary.

B3—28 to 32 inches, brown (10YR 5/3) clay loam; weak, coarse, subangular blocky structure; firm; brown (10YR 4/3) clay films on faces of peds; less than 5 percent cobbles and pebbles; interiors of peds have slight effervescence, exteriors of peds are neutral; clear, wavy boundary.

C—32 to 60 inches, yellowish-brown (10YR 5/4) clay loam; weak, thick, platy structure parting to moderate, fine, subangular blocky; friable; less than 5 percent cobbles and pebbles; slight effervescence; mildly alkaline.

The solum ranges from 20 to 45 inches in thickness, which coincides with depth to effervescent material. The upper part of the solum is medium acid to neutral and the lower part is neutral or mildly alkaline. Cobbles and pebbles range from 2 percent to 10 percent throughout the soils.

The Ap horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3). In some places a grayish-brown (10YR 5/2), brown (10YR 5/3), or yellowish-brown (10YR 5/4) A2 horizon is present. It is loam, sandy loam, or clay loam. In uncultivated areas the A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2), and the A2 horizon is near maximum thickness.

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The lower part of the B horizon has mottles in some pedons. It is clay loam, heavy clay loam, silty clay loam, silty clay, or light clay.

The C horizon is brown (10YR 5/3) or yellowish brown (10YR 5/4) and is mottled in some pedons. It is clay loam or silty clay loam.

The Morley soils are generally near Owosso, Blount, and Pewamo soils in most landscapes. They have more clay and less sand in the upper part of the subsoil than the Owosso soils. They lack the gray color in the subsoil that is in the Blount and Pewamo soils.

MoB—Morley loam, 2 to 6 percent slopes. This soil is in broad upland areas and on low rises and side slopes of till plains and moraines. Areas are irregular in shape and range from 3 to 320 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of St. Clair clay loam, Miami loam, Owosso sandy loam, Blount loam, and Pewamo clay loam. Small areas of soils that are less than 20 inches deep over the underlying material are also included. Some small areas of poorly drained and steeper soils are identified on the

soil map by spot symbols. Small areas of nearly level soils are also included.

The hazard of erosion is slight. Surface runoff is slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIe–1 (1.5a); woodland group 2o2; woody plant group 4; recreation group 17.

MoC—Morley loam, 6 to 12 percent slopes. This soil is in broad areas and along streams and drainageways of till plains and moraines. Slopes in the broad areas are short and complex. Areas are irregular in shape and range from 3 to 180 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is slightly less. Some dark yellowish-brown subsoil is incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of St. Clair clay loam, Miami loam, Owosso sandy loam, and Blount loam. Small areas of soils that are less than 20 inches deep over the underlying material are also included. Some small areas of poorly drained, very poorly drained, and steeper soils are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

The hazard of erosion is moderate. Runoff is medium. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIIe–4 (1.5a); woodland group 2o2; woody plant group 4; recreation group 18.

MoD—Morley loam, 12 to 18 percent slopes. This soil is in broad areas and along streams and drainageways of till plains and moraines. Slopes in the broad areas are short and complex. Areas are irregular in shape and range from 3 to 40 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is significantly less. Some dark yellowish-brown subsoil is incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of St. Clair clay loam, Owosso sandy loam, Miami loam, and Blount loam. Many small areas of severely eroded soils that are less than 20 inches deep over the underlying material are also included. Some small areas of wet depressional soils and steeper soils are identified on the soil map by spot symbols. Small areas of sloping soils are also included.

The hazard of erosion is severe. Runoff is rapid. Complex slopes make tillage difficult.

Most of the acreage is used for crops, woodland, and permanent pasture. Capability unit IVe–1 (1.5a); woodland group 2o2; woody plant group 4; recreation group 13.

MoE—Morley loam, 18 to 25 percent slopes. This steep soil is in broad areas and along streams and drainageways of till plains and moraines. Slopes in the broad areas are short and complex. Areas are irregular or elongated in shape and range from 3 to 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is significantly less. Many areas have a thinner, darker colored surface layer and a light-colored subsurface layer that are not characteristic of the soil described by the representative profile.

Included with this soil in mapping are small areas of St. Clair clay loam, Miami loam, and Fox sandy loam. Many small areas of severely eroded soils that are less than 20 inches deep over the underlying material are also included. Some small areas of wet depressional soils are identified on the soil map by spot symbols. Some areas of moderately steep and very steep soils are also included.

The hazard of erosion is very severe. Runoff is rapid.

Most of the acreage is used for woodland, permanent pasture, and wildlife. Capability unit VIe–1 (1.5a); woodland group 2r2; woody plant group 4; recreation group 13.

Nappanee Series

The Nappanee series consists of somewhat poorly drained, nearly level, and gently sloping soils formed in loamy and clayey textured glacial till. These soils are on till plains, moraines, and lake plains.

In a representative profile the surface layer is dark grayish-brown silty clay loam 8 inches thick. The subsoil is firm, mottled brown, and 12 inches thick. The upper part is silty clay, and the lower part is clay. The underlying material is grayish-brown silty clay.

The Nappanee soils have a moderate available water capacity. Permeability is very slow.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Nappanee silty clay loam, 2 to 6 percent slopes, 1,180 feet east and 240 feet north of center sec. 30, T. 2 S., R. 5 E., in a cultivated area:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silty clay loam; weak, medium, angular blocky structure; firm; slightly acid; abrupt, smooth boundary.

B21t—8 to 14 inches, brown (10YR 5/3) silty clay; few, fine, faint, grayish-brown (10YR 5/2) and common, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, angular blocky structure; firm; continuous, thin, gray (10YR 5/1) clay films on faces of peds and in worm channels; slightly acid; gradual, wavy boundary.

B22t—14 to 20 inches, brown (10YR 5/3) clay; common, medium, distinct, grayish-brown (10YR 5/2) and gray (5Y 5/1) mottles; moderate, medium, angular blocky structure; firm; continuous, thin, gray (10YR 5/1) and yellowish-brown (10YR 5/4) clay films on faces of peds and in worm channels; mildly alkaline; clear, wavy boundary.

Cg—20 to 60 inches, grayish-brown (10YR 5/2) silty clay; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, angular blocky structure; firm; strong effervescence; moderately alkaline.

The solum ranges from 18 to 40 inches in thickness, which coincides with depth to effervescent material. The solum is medium acid to mildly alkaline.

The Ap horizon is dark grayish-brown (10YR 4/2) or grayish-brown (10YR 5/2) silty clay loam or loam. The A2 horizon, if present, is yellowish-brown (10YR 5/4) silty clay loam. In uncultivated areas the A1 horizon is very dark gray (10YR 3/1) or very dark grayish-brown (10YR 3/2) silty clay loam, silt loam, or loam, and the A2 horizon is near maximum thickness.

The B horizon has a hue of 10YR, value of 4 to 6, and chroma of 1 to 3. It is mottled in the upper part in many pedons, and mottled in the lower part. It is silty clay or clay.

The C horizon is grayish brown (10YR 5/2) or light

grayish brown (10YR 6/2) and is mottled. It is silty clay or clay.

The Nappanee soils are generally near St. Clair, Ypsi, and Hoytville soils in most landscapes. They differ from the St. Clair soils in having gray color in the subsoil. They have more clay and less sand in the subsoil than the Ypsi soils. They are less gray in the subsoil than the Hoytville soils.

NaA—Nappanee silty clay loam, 0 to 2 percent slopes. This soil is in broad low-lying areas and along drainageways of till plains, moraines, and lake plains. Areas are irregular in shape and range from 4 to about 120 acres in size.

This soil has a profile similar to the one described as representative of the series, but the subsoil is significantly thicker.

Included with this soil in mapping are small areas of Blount loam, St. Clair clay loam, and Hoytville silty clay loam. Some small areas of Ypsi sandy loam, poorly drained soils, and very poorly drained soils are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

This soil has a seasonal high water table. Runoff is very slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIIw–2 (1b); woodland group 2c1; woody plant group 2; recreation group 19.

NaB—Nappanee silty clay loam, 2 to 6 percent slopes. This soil is on foot slopes and along drainageways of till plains, moraines, and lake plains. Areas are irregular in shape and range from 3 to about 550 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of St. Clair clay loam and Hoytville silty clay loam. Some small areas of Ypsi sandy loam, poorly drained soils, very poorly drained soils, and steeper soils are identified on the soil map by spot symbols. Small areas of nearly level soils are also included.

This soil has a seasonal high water table. The hazard of erosion is moderate. Runoff is slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIIe–7 (1b); woodland group 2c1; woody plant group 2; recreation group 19.

Oakville Series

The Oakville series consists of well drained and moderately well drained, nearly level to sloping soils formed in sandy textured glaciofluvial deposits or lacustrine deposits. These soils are on outwash plains, beach ridges, lake plains, kames, and moraines.

In a representative profile the surface layer is dark grayish-brown fine sand 10 inches thick. The subsoil is 23 inches of loose fine sand. The upper part is strong brown and the lower part is yellowish brown. The underlying material is light yellowish-brown fine sand.

Oakville soils have a low available water capacity. Permeability is very rapid.

Most of the nearly level and gently sloping areas are used for crops. Some small areas are in woodland or are mined for sand. Sloping areas are used for woodland and recreation.

Representative profile of Oakville fine sand, 0 to 6 percent slopes, 1,840 feet south and 760 feet west of the northeast corner sec. 14, T. 2 S., R. 5 E., in a cultivated area:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) fine sand; weak, fine, granular structure; very friable; common fine roots; medium acid; abrupt, smooth boundary.

B21—10 to 18 inches, strong-brown (7.5YR 5/6) fine sand; single grained; loose; few fine roots; slightly acid; clear, wavy boundary.

B22—18 to 33 inches, yellowish-brown (10YR 5/6) fine sand; single grained; loose; few fine roots; slightly acid; gradual, wavy boundary.

C—33 to 60 inches, light yellowish-brown (10YR 6/4) fine sand; single grained; loose; very few fine roots; neutral.

The solum ranges from 25 to 40 inches in thickness. It is medium acid to neutral.

The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). In some places an A2 horizon of brown (10YR 5/3) fine sand is present. In uncultivated areas the A1 horizon is black (10YR 2/1) or very dark brown (10YR 2/2), and the A2 horizon is near maximum thickness.

The B horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8.

The C horizon is pale-brown (10YR 6/3), yellowish-brown (10YR 5/4, 5/6), or light yellowish-brown (10YR 6/4) fine sand or sand.

The Oakville soils are generally near Tedrow, Granby, and Spinks soils in most landscapes. They are brown in the subsoil and lack the gray color characteristic of the Tedrow and Granby soils. They lack the bands of clay accumulation in the subsoil, which occur in the Spinks soils.

OaB—Oakville fine sand, 0 to 6 percent slopes. This soil is in broad upland areas and on outwash plains, beach ridges, lake plains, kames, and moraines. Areas are irregular in shape and range from 3 to 60 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Spinks loamy sand, Oshtemo loamy sand, Tedrow loamy fine sand, and Granby fine sand. Some small areas of poorly drained and steeper soils are identified on the soil map by spot symbols.

This soil is droughty and is subject to soil blowing if cultivated. Runoff is slow or very slow.

Most of the acreage is used for crops. Some small areas are in woodland or are mined for sand. Capability unit IVs–1 (5a); woodland group 2s5; woody plant group 3; recreation group 20.

OaC—Oakville fine sand, 6 to 12 percent slopes. This soil is in broad upland areas and on side slopes of outwash plains and beach ridges. Areas are irregular in shape and range from 3 to 40 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is slightly less.

Included with this soil in mapping are small areas of Spinks loamy sand, Oshtemo loamy sand, Boyer loamy sand, Tedrow loamy sand, and Granby fine sand. Small areas of poorly drained, very poorly drained, and steeper soils are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

This soil is droughty and is subject to soil blowing. The hazard of erosion is moderate. Runoff is slow.

Most of the acreage is used for woodland and recreation. Some small areas are mined for sand. Capability unit IVs–1 (5a); woodland group 2s5; woody plant group 3; recreation group 20.

Oshtemo Series

The Oshtemo series consists of well drained, nearly level to sloping soils formed in loamy and sandy textured deposits. These soils are on outwash plains, valley trains, moraines, and beach ridges.

In a representative profile the surface layer is dark-brown loamy sand 9 inches thick. The subsurface layer is 3 inches of yellowish-brown loamy sand. The subsoil is 48 inches thick. The upper part is dark yellowish-brown, very friable loamy sand. Below this is reddish-brown, firm gravelly sandy clay loam. Next is dark yellowish-brown, very friable loamy sand that has bands of dark-brown, friable sandy loam. Below this is dark reddish-brown, friable heavy sandy loam. The lower part is dark yellowish-brown, very friable loamy sand.

Oshtemo soils have a low available water capacity. Permeability is moderately rapid.

Most of the acreage is used for crops, recreation, and woodland. Some small areas are mined for sand and gravel.

Representative profile of Oshtemo loamy sand, 0 to 6 percent slopes, in an area of Spinks-Oshtemo loamy sands, 1,280 feet north and 740 feet west of the southeast corner of NE¼ sec. 20, T. 2 S., R. 5 E., in a cultivated area:

Ap—0 to 9 inches, dark-brown (10YR 4/3) loamy sand; weak, fine, granular structure; very friable; neutral; abrupt, smooth boundary.

A2—9 to 12 inches, yellowish-brown (10YR 5/4) loamy sand; moderate, fine, granular structures; very friable; slightly acid; clear, smooth boundary.

B1—12 to 18 inches, dark yellowish-brown (10YR 4/4) loamy sand; weak, fine, granular structure; very friable; slightly acid; clear, smooth boundary.

B21t—18 to 24 inches, reddish-brown (5YR 4/4) gravelly sandy clay loam; weak, medium to coarse, subangular blocky structure; firm; 25 percent pebbles; strongly acid; abrupt, wavy boundary.

B22t—24 to 31 inches, dark yellowish-brown (10YR 4/4) loamy sand; weak, fine, subangular blocky structure; very friable; dark-brown (7.5YR 4/4) sandy loam bands total 2 inches; weak, fine subangular blocky structure; friable; medium acid; abrupt, wavy boundary.

B23t—31 to 40 inches, dark reddish-brown (5YR 3/4) heavy sandy loam; weak, coarse, subangular blocky structure; friable; medium acid; abrupt, wavy boundary.

B3—40 to 60 inches, dark yellowish-brown (10YR 4/4) loamy sand; few, coarse, prominent, strong-brown (7.5YR 5/6) and many, coarse, prominent, light brownish-gray (10YR 6/2) mottles; weak, coarse, subangular blocky structure; very friable; slightly acid in the upper part and neutral in the lower part.

The solum ranges from 40 to 66 inches in thickness which coincides with depth to effervescent material. The solum is neutral to strongly acid. Pebbles range from less than 1 percent to 25 percent in the solum and from 10 percent to 65 percent in the underlying material.

The Ap horizon is dark grayish-brown (10YR 4/2) or dark-brown (10YR 4/3) loamy sand or sandy loam. The A2 horizon, if present, is yellowish brown (10YR 5/4) or light yellowish brown (10YR 6/4). In uncultivated areas the A1 horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3), and the A2 horizon is near maximum thickness.

The B1 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. A B1 horizon is not in all pedons. The B2t horizon is reddish brown (5YR 4/4), dark yellowish brown (10YR 4/4), dark reddish brown (5YR 5/4), yellowish brown (10YR 5/6), brown (7.5YR 4/4), or strong brown (7.5YR 5/6). It is sandy loam, heavy sandy loam, sandy clay loam, loamy sand, or gravelly sandy clay loam.

The B3 horizon is dark yellowish brown (10YR 4/4) or yellowish brown (10YR 5/6). In some pedons in the lower part of the B3 horizon there are sandy loam layers ⅛ to 4 inches thick. The B3 horizon is absent in some pedons.

The IIC horizon, if present, is grayish-brown (10YR 5/2), brown (10YR 5/3), yellowish-brown (10YR 5/4), pale-brown (10YR 6/3), or light yellowish-brown (10YR 6/4) stratified sand and gravelly sand.

The Oshtemo soils are generally near Boyer, Spinks, and Riddles soils in most landscapes. They have a thicker solum than the Boyer soils. They have more clay and gravel than the Spinks soils. They have less silt and clay and more sand in the underlying material than the Riddles soils.

OsB—Oshtemo loamy sand, 0 to 6 percent slopes. This soil is in broad upland areas and on outwash plains, valley trains, moraines, and beach ridges. Slopes are uniform or short and complex. Areas are irregular in shape and range from 3 to about 100 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Boyer loamy sand, Spinks loamy sand, Fox sandy loam, Oakville fine sand, and Wasepi sandy loam. Some small areas of poorly drained and steeper soils are identified on the soil map by spot symbols.

This soil is droughty and is subject to soil blowing if cultivated. Runoff is slow or very slow.

Most of the acreage is used for crops, recreation, and woodland. Some small areas are mined for sand and gravel. Capability unit IIIs–1 (4a); woodland group 2s5; woody plant group 3; recreation group 3.

OsC—Oshtemo loamy sand, 6 to 12 percent slopes. This soil is in areas that have uniform slopes and in pitted outwash areas and on outwash plains, valley trains, moraines, and beach ridges. Areas are irregular in shape and range from 3 to about 200 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is slightly less. The yellowish-brown loamy sand subsurface layer and some dark yellowish-brown subsoil are incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Spinks loamy sand, Boyer loamy sand, Oakville fine sand, and Wasepi sandy loam. Some small areas of poorly drained soils, very poorly drained soils, steeper soils, and depressions are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

The hazard of erosion is moderate. This soil is droughty and subject to soil blowing if cultivated. Runoff is slow. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops, recreation, and woodland. Some small areas are mined for sand and gravel. Capability unit IIIe–3 (4a); woodland group 2s5; woody plant group 3; recreation group 4.

Owosso Series

The Owosso series consists of well-drained, gently sloping, and sloping soils formed in a thin layer of loamy textured glaciofluvial deposits over loamy textured glacial till. These soils are on till plains and moraines.

In a representative profile the surface layer is dark-brown sandy loam 10 inches thick. The subsurface layer is 2 inches of yellowish-brown sandy loam. The subsoil is 17 inches thick. The upper part is yellowish-brown, very friable sandy loam. The middle part is dark-brown, friable heavy sandy loam. The lower part is brown, firm loam. The upper part of the underlying material is mottled brown light loam, and the lower part is yellowish-brown loam.

Owosso soils have a moderate available water capacity. Permeability is moderately rapid in the sandy loam upper layers and moderately slow in the loamy lower layers.

Most of the acreage is used for crops. Some small areas are in woodland.

The Owosso soils in this county are mapped only with Miami soils.

Representative profile of Owosso sandy loam, 2 to 6 percent slopes, in an area of Owosso-Miami complex, 1,000 feet south and 90 feet west of the northeast corner of the SE¼ sec. 20, T. 2 S., R. 5 E., in a cultivated area:

Ap—0 to 10 inches, dark-brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; weak, fine, granular structure; very friable; neutral; abrupt, smooth boundary.

A2—10 to 12 inches, yellowish-brown (10YR 5/4) sandy loam; weak, medium, platy structure; very friable; neutral; clear, smooth boundary.

B11—12 to 15 inches, yellowish-brown (10YR 5/4) sandy loam; weak, medium, subangular blocky structure; very friable; neutral; clear, wavy boundary.

B12—15 to 20 inches, dark-brown (10YR 4/3) heavy sandy loam; moderate, medium, subangular blocky structure; very friable; neutral; clear, wavy boundary.

B21t—20 to 25 inches, dark-brown (7.5YR 4/4) heavy sandy loam; moderate, medium, subangular blocky structure; friable; few, dark-brown (7.5YR 4/4) clay flows in pores; neutral; clear, wavy boundary.

IIB22t—25 to 29 inches, brown (10YR 4/3) loam; moderate, medium, subangular blocky structure; firm; continuous, thick, dark-brown (7.5YR 4/4) clay films on faces of peds; mildly alkaline; clear, wavy boundary.

IIC1—29 to 35 inches, brown (10YR 4/3) light loam; common, medium, distinct, gray (10YR 6/1) mottles; weak, medium, subangular blocky structure; friable; slight effervescence; mildly alkaline; gradual, wavy boundary.

IIC2—35 to 60 inches, yellowish-brown (10YR 5/4) loam; massive; friable; few, fine, pale-brown (10YR 6/3) lime segregations; strong effervescence; moderately alkaline.

The solum ranges from 24 to 45 inches in thickness, which coincides with depth to effervescent material. The solum is medium acid to neutral in the upper part and slightly acid to mildly alkaline in the lower part. Pebbles and cobbles range from 1 percent to 5 percent throughout the solum.

The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 3/3, 4/3), or very dark grayish brown (10YR 3/2) moist. The A2 horizon is brown (10YR 5/3), yellowish-brown (10YR 5/4), or pale-brown (10YR 6/3) sandy loam or loamy sand. It is absent in some pedons. In uncultivated areas the A1 horizon is very dark gray (10YR 3/1) sandy loam, and the A2 horizon is near maximum thickness.

The upper part of the B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam or heavy loamy sand. The IIB horizon is brown (10YR 4/3), dark yellowish-brown (10YR 4/4), or yellowish-brown (10YR 5/4) heavy loam, clay loam, or silty clay loam.

The IIC horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4, and is mottled in some pedons. It is loam, clay loam, or silty clay loam.

The Owosso soils are generally near Miami, Morley, Metamora, and Boyer soils in most landscapes. They have more sand and less clay in the upper part of the subsoil than the Miami and Morley soils. They lack the gray in the subsoil of the Metamora soils. They have more silt and clay and less sand in the underlying material than the Boyer soils.

OwB—Owosso-Miami complex, 2 to 6 percent slopes. This mapping unit is in broad upland areas and on low rises and side slopes of till plains and moraines. Areas are irregular in shape and range from about 3 to about 120 acres in size.

The Owosso soils in this unit have the profile described as representative of the Owosso series. The Miami soils in this unit have a profile similar to the one described as representative of the Miami series, but some areas have more sand in the surface layer. Owosso soils make up about 50 percent of the acreage, and Miami soils make up about 30 percent.

Included with this unit in mapping, and making up about 20 percent of the acreage, are small areas of Morley loam, Metamora sandy loam, Boyer loamy sand, Kendallville loam, and Fox sandy loam. Some small areas of poorly drained and steeper soils are identified on the soil map by spot symbols. Small areas of nearly level soils are also included.

The hazard of erosion is slight. Runoff is slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIe–2 (3/2a and 2.5a); woodland group 1o1; woody plant group 4; recreation group 11.

OwC—Owosso-Miami complex, 6 to 12 percent slopes. This mapping unit is in broad areas and along streams and drainageways of till plains and moraines. Slopes in the broad areas are short and complex. Areas are irregular in shape and range from 3 to about 40 acres in size.

The Owosso and Miami soils in this unit have profiles similar to the ones described as representative of the series, but depth to the underlying material is slightly less. In the Owosso soils, the subsurface layer and some yellowish-brown subsoil are incorporated into the surface layer in cultivated areas. In the Miami soils, some dark-brown subsoil is incorporated into the surface layer in cultivated areas. Owosso soils make up about 45 percent of the acreage, and Miami soils make up about 30 percent.

Included with this unit in mapping, and making up about 25 percent of the acreage, are small areas of Morley loam, Metamora sandy loam, Boyer loamy sand, Kendallville loam, Fox sandy loam, and Kidder sandy loam. Some small areas of poorly drained, very poorly drained, and steeper soils are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

The hazard of erosion is moderate. Runoff is medium. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIIe–5 (3/2a and 2.5a); woodland group 1o1; woody plant group 4; recreation group 12.

Palms Series

The Palms series consists of nearly level, very poorly drained soils formed in organic deposits overlying loamy mineral layers. These soils are on till plains, moraines, and lake plains.

In a representative profile the upper layer is black muck 30 inches thick. The underlying material is dark-gray fine sandy loam and loam.

Palms soils have a very high available water capacity. Permeability is rapid in the muck and moderate in the underlying material.

Most of the acreage is used for wildlife, crops, and woodland. Some areas are in permanent pasture.

Representative profile of Palms muck, 125 feet east and 20 feet south of the northwest corner of the NE¼ sec. 23, T. 3 S., R. 3 E., in a cultivated area:

Oa1—0 to 10 inches, black (N 2/0) sapric material; moderate, medium, granular structure; friable; less than 5 percent fiber; slightly acid; abrupt, smooth boundary.

Oa2—10 to 25 inches, black (N 2/0) sapric material; moderate, medium, subangular blocky structure; friable; 10 percent fiber, less than 5 percent rubbed; slightly acid; clear, smooth boundary.

Oa3—25 to 30 inches, black (N 2/0) sapric material; weak, thick, platy structure parting to weak, very fine, subangular blocky; friable; less than 5 percent fiber; 25 percent mineral material; neutral; clear, smooth boundary.

IIC1g—30 to 34 inches, dark-gray (10YR 4/1) fine sandy loam; massive; very friable; mildly alkaline; abrupt, smooth boundary.

IIIC2g—34 to 50 inches, dark-gray (5Y 4/1) heavy loam; massive; firm; slight effervescence; mildly alkaline; clear, smooth boundary.

IIIC3g—50 to 60 inches, dark-gray (5Y 4/1) loam; common, coarse, prominent, dark yellowish-brown (10YR 4/4) mottles; massive; friable; thin, less than ¼ inch bands of fine sand; strong effervescence; mildly alkaline.

The depth to the Cg horizon ranges from 16 to 50 inches. The organic material is medium acid to neutral. In some pedons woody fragments make up about 10 percent of the organic material. This material contains less than 25 percent fiber unrubbed and less than 5 percent fiber rubbed. The underlying material ranges from fine sandy loam to light silty clay loam. It is neutral to moderately alkaline.

The Palms soils in most landscapes are near the Houghton, Adrian, and Edwards soils (fig. 9). They have a thinner organic layer than the Houghton soils. They have more silt and clay and less sand in the underlying material than the Adrian soils. They are underlain by loam, whereas the Edwards soils are underlain by marl.

Pa—Palms muck. This soil is in broad low-lying areas and along waterways of till plains, moraines, and lake plains. Slope is 0 to 2 percent. Areas are irregular in shape and range from 3 to more than 150 acres in size.

Included with this soil in mapping are small areas of Houghton muck, Adrian muck, Edwards muck, Brookston loam, and Pewamo clay loam. Some small areas of soils where the organic layer has free carbonates and soils that have clay underlying material are also included.

This soil is too wet for crop production unless

Figure 9.—Truck gardening on Palms, Houghton, Adrian, and Edwards soils. Darker areas are mainly Houghton muck; lighter areas are Palms muck.

drained. It has a high water table and is subject to flooding. If cleared and drained, it is subject to soil blowing, subsidence, burning, and frost damage. Runoff is very slow.

Most of the acreage is used for wildlife, crops, and woodland. Some areas are in permanent pasture. Capability unit IIw–1 (M/3c); woodland group 4w2; woody plant group 1; recreation group 1.

Pella Series

The Pella series consists of poorly drained and very poorly drained, nearly level soils formed in loamy deposits. These soils are on lake plains and outwash plains.

In a representative profile (fig. 10) the surface layer is very dark brown silt loam 12 inches thick. The subsoil is mottled and is 13 inches thick. The upper part is very dark gray, friable heavy silt loam. The lower part is gray, firm heavy silt loam. The underlying material is mottled gray, stratified silt loam and silty clay loam.

Pella soils have a high available water capacity. Permeability is moderate.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Pella silt loam, 298 feet west and 475 feet south of the northeast corner of NW¼ sec. 29, T. 3 S., R. 6 E., in a cultivated area:

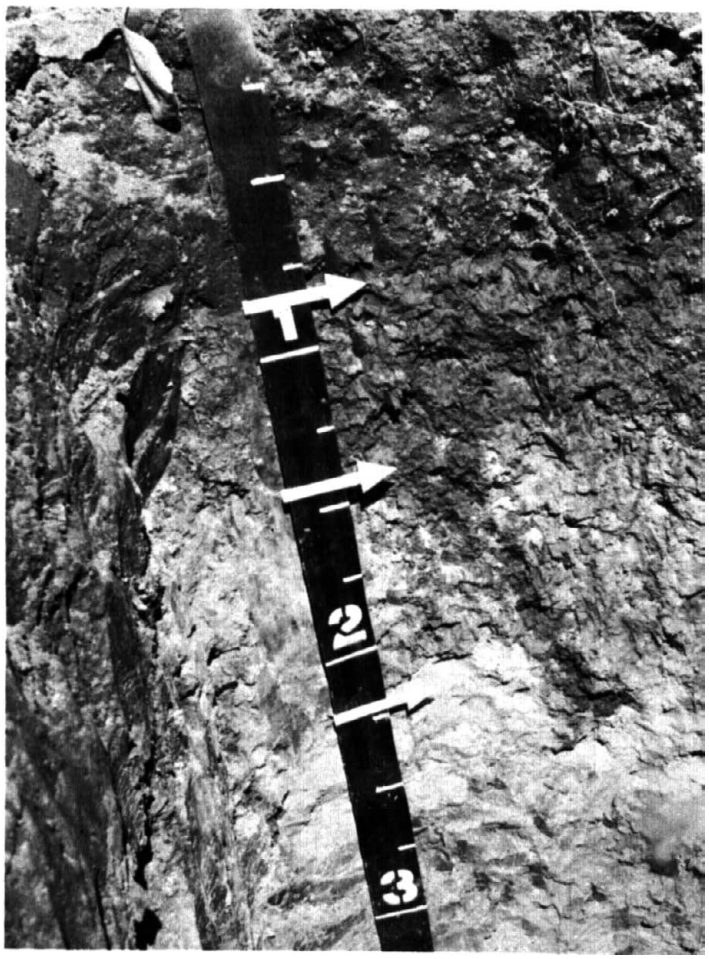

Figure 10.—**Profile of Pella silt loam. Depth is marked in feet.**

Ap—0 to 12 inches, very dark brown (10YR 2/2) silt loam; moderate, medium and fine, granular structure; friable; common fine roots; neutral; abrupt, smooth boundary.

B21g—12 to 20 inches, very dark gray (10YR 3/1) heavy silt loam, dark grayish brown (10YR 4/2) crushed; many, fine, prominent, light reddish-brown (5YR 6/4), common, medium, prominent, gray (5Y 6/1), and common, fine, distinct, yellowish-brown (10YR 5/4) mottles; moderate, coarse, subangular blocky structure parting to moderate, fine, angular blocky; friable; few fine roots; neutral; clear, irregular boundary.

B22g—20 to 25 inches, gray (5Y 5/1) heavy silt loam; common, medium, prominent, strong-brown (7.5YR 5/6) and few, fine, prominent, yellowish-red (5YR 4/6) mottles; moderate, medium, angular blocky structure; firm; gray (5YR 5/1) silt coatings on vertical faces of peds; few fine roots; neutral; abrupt, smooth boundary.

C1g—25 to 35 inches, gray (5Y 6/1) silt loam; few, medium, prominent, strong-brown (7.5YR 5/6) and brownish-yellow (10YR 6/6) and few, fine, distinct, dark-gray (5Y 4/1) mottles; moderate, medium and thin, platy structure parting to moderate, very fine, subangular blocky; friable; very thin (2 to 4 millimeters) horizontal strata of very fine sand and silt; few, thin roots; slight effervescence; mildly alkaline; abrupt, smooth boundary.

C2g—35 to 45 inches, gray (5Y 5/1) silty clay loam; common, medium, prominent, yellowish-brown (10YR 5/4), few, fine, prominent, strong-brown (7.5YR 5/6), and few, fine, faint, gray (5Y 6/1) mottles; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky; very firm; few fine roots; strong effervescence; mildly alkaline; abrupt, smooth boundary.

C3g—45 to 50 inches, mottled gray (5Y 5/1) and yellowish-brown (10YR 5/4) silt loam; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, platy structure; firm; few thin, gray (5Y 5/1) clay films on vertical faces of some peds; dark-gray (10YR 4/1) krotovinas; strong effervescence; mildly alkaline; abrupt, smooth boundary.

C4g—50 to 60 inches, gray (5Y 5/1) silt loam; common, medium, prominent, yellowish-brown (10YR 5/4) mottles; massive; friable; thin (2 to 50 millimeters) strata of very fine sand, fine sand, and silty clay loam; strong effervescence; mildly alkaline.

The solum ranges from 20 to 40 inches in thickness. It is slightly acid to mildly alkaline. Pebble content is less than 1 percent throughout the solum.

The Ap horizon is very dark brown (10YR 2/2), black (10YR 2/1), or very dark gray (10YR 3/1) silt loam or loam.

The Bg horizon is very dark gray (10YR 3/1), dark gray (10YR 4/1), or gray (10YR 5/1, 6/1) (5Y 5/1, 6/1) and is mottled.

The Cg horizon is gray (5Y 5/1, 6/1) and is mottled.

The Pella soils are generally near Kibbie, Colwood, and Lamson soils in most landscapes. They are more gray in the subsoil that the Kibbie soils. They have less sand in the subsoil that Lamson, Kibbie, and Colwood soils.

Pc—Pella silt loam. This soil is in depressional areas, broad low-lying areas, and drainageways of lake plains and outwash plains. Slope is 0 to 2 percent. Areas are irregular in shape and range from 5 to 180 acres in size.

Included with this soil in mapping are small areas of Granby fine sand, Colwood loam, Palms muck, Lamson fine sandy loam, and Kibbie loam. Small areas of soils that are less than 20 inches deep over the underlying material are also included. Some small areas of organic soils are identified on the soil map by a spot symbol.

This soil has a high water table and is too wet for crop production unless drained. Runoff is very slow. Depressional areas are subject to flooding by runoff from adjacent areas.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIw–5 (2.5c); woodland group 3w1; woody plant group 5; recreation group 7.

Pewamo Series

The Pewamo series consists of poorly drained and very poorly drained, nearly level soils formed in loamy textured glacial till or lacustrine deposits. These soils are on till plains, moraines, and lake plains.

In a representative profile the surface layer is very dark brown clay loam 13 inches thick. The subsoil is firm, mottled, and is 24 inches thick. The upper part is dark-gray silty clay. The lower part is gray silty loam. The underlying material is mottled grayish-brown silty clay loam.

Pewamo soils have a high available water capacity. Permeability is moderately slow.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Pewamo clay loam, 100 feet south and 300 feet west of the northeast corner sec. 26, T. 2 S., R. 7 E., in a cultivated area:

Ap—0 to 10 inches, very dark brown (10YR 2/2) clay loam; weak, medium, granular structure; firm; 3 percent pebbles; slightly acid; abrupt, smooth boundary.

A12—10 to 13 inches, very dark brown (10YR 2/2) clay loam; weak, medium, angular blocky structure; firm; 3 percent pebbles; slightly acid; gradual, wavy boundary.

B21tg—13 to 25 inches, dark-gray (10YR 4/1) silty clay; common, medium, distinct, very dark gray (10YR 3/1) and strong-brown (7.5YR 5/6) mottles; moderate, medium, angular blocky structure; firm; 2 percent pebbles; few, thin clay films on faces of peds; slightly acid; gradual, wavy boundary.

B22tg—25 to 37 inches, gray (10YR 5/1) silty clay; common, medium, distinct, yellowish-brown (10YR 5/6) and common, medium, faint-gray (N 5/0) mottles; moderate, medium, angular blocky structure; firm; 2 percent pebbles; neutral; gradual, wavy boundary.

Cg—37 to 60 inches, grayish-brown (10YR 5/2) silty clay loam; common, medium, distinct, light gray (10YR 6/1) and brownish-yellow (10YR 6/6) mottles; massive; firm; 4 percent pebbles; strong effervescence; mildly alkaline.

The solum ranges from 28 to 48 inches in thickness, which coincides with depth to effervescent material. The solum is slightly acid to mildly alkaline. Pebbles range from 1 to 5 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is clay loam or loam.

The Bg horizon has hue of 5Y to 10YR, value of 4 to 6, and chroma of 1 or 2 and is mottled. It is clay loam, silty clay loam, silty clay, or clay.

The Cg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2 and is mottled. It is clay loam or silty clay loam.

The Pewamo soils in most landscapes are near the Morley, Blount, Wauseon, and Brookston soils. They have gray subsoils, whereas the Morley soils have brown subsoils. They are more gray in the subsoil than the Blount soils. They have more clay and less sand in the subsoil than the Wauseon soils. They have more clay in the subsoil and underlying material than the Brookston soils.

Pe—Pewamo clay loam. This soil is in depressional areas, broad low-lying areas, and drainageways of till plains, moraines, and lake plains. Slope is 0 to 2 percent. Areas are irregular in shape and range from 3 to over 200 acres in size.

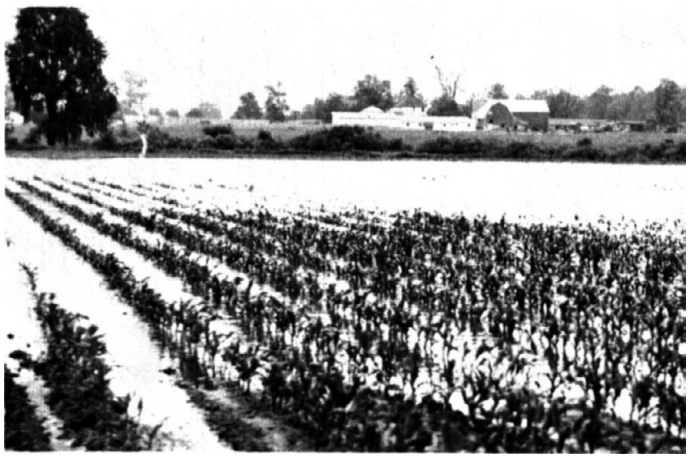

Figure 11.—Area of Pewamo soils.

Included with this soil in mapping are small areas of Blount loam, Nappanee silty clay loam, Palms muck, Hoytville silty clay loam, and Brookston loam. Some small areas of Wauseon fine sandy loam, and small areas of soils where depth to the underlying material is less than 28 inches are also included. Some small areas of organic soils are identified on the soil map by a spot symbol.

This soil has a high water table and is too wet for crop production unless drained. Runoff is very slow. Depressional areas are subject to flooding by runoff from adjacent areas (fig. 11).

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIw–2 (1.5c); woodland group 2w1; woody plant group 5; recreation group 7.

Riddles Series

The Riddles series consists of well-drained, gently sloping, and sloping soils formed in loamy and sandy textured glacial till. These soils are on till plains and moraines.

In a representative profile (fig. 12) the surface layer is dark grayish-brown sandy loam 9 inches thick. The subsurface layer is 4 inches of yellowish-brown sandy loam. The subsoil is 37 inches thick. The upper part is yellowish-brown, friable heavy sandy loam. The next part is brown, firm sandy clay loam. The lower part is dark yellowish-brown, friable sandy clay loam. The underlying material is yellowish-brown light sandy loam.

Riddles soils have a moderate available water capacity. Permeability is moderate.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Riddles sandy loam, 2 to 6 percent slopes, 280 feet west and 900 feet north of the southeast corner sec. 24, T. 1 S., R. 3 E., in a cultivated area:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) sandy

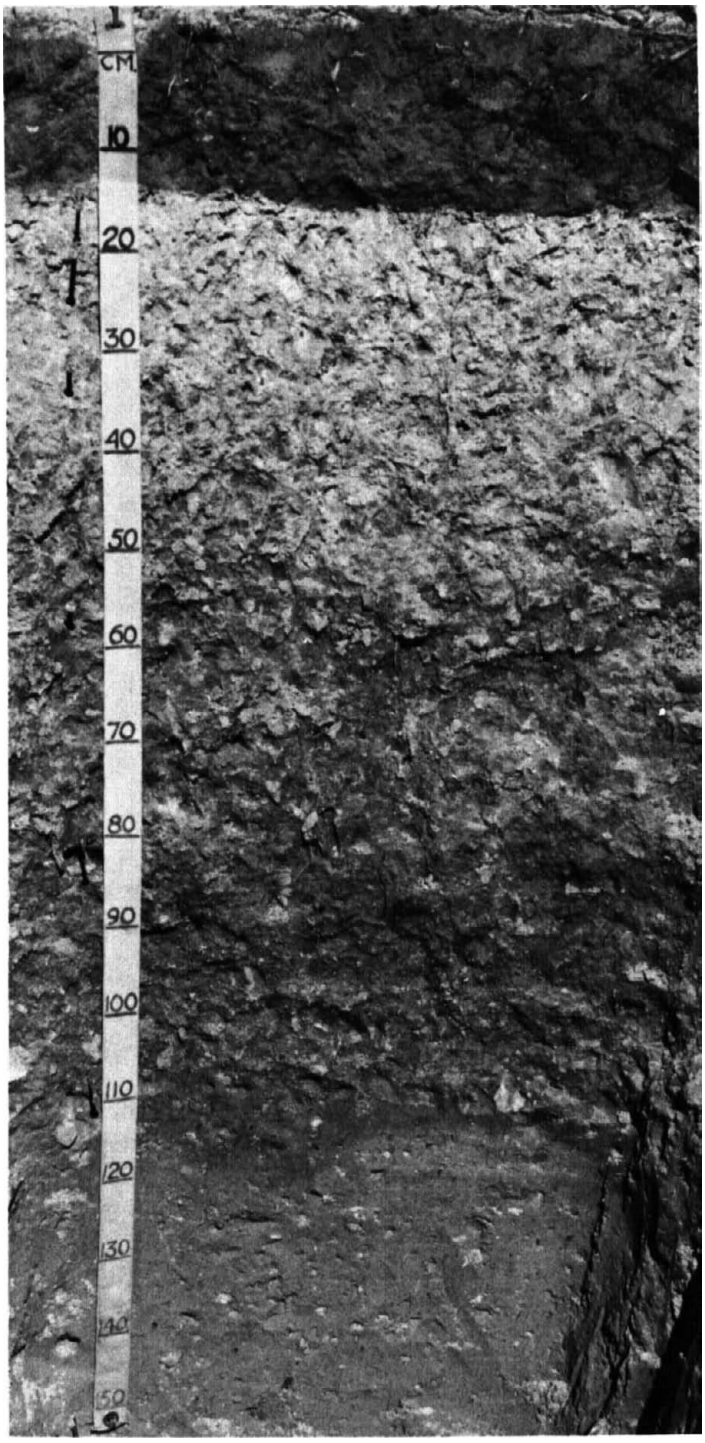

Figure 12.—**Profile of Riddles sandy loam. Depth is marked in centimeters.**

loam; moderate, fine, subangular blocky structure; friable; 5 percent pebbles; slightly acid; abrupt, smooth boundary.

A2—9 to 13 inches, yellowish-brown (10YR 5/4) sandy loam; moderate, medium, platy structure; friable; 5 percent pebbles; slightly acid; clear, wavy boundary.

B21t—13 to 17 inches, yellowish-brown (10YR 5/6) heavy sandy loam; moderate, coarse, subangular blocky structure; friable; common, thin, dark yellowish-brown (10YR 4/4) clay films on faces of peds; 5 percent pebbles; medium acid; clear, smooth boundary.

B22t—17 to 39 inches, brown (7.5YR 4/4) sandy clay loam; moderate, medium, subangular blocky structure; firm; continuous, thin clay films on faces of peds; 5 percent pebbles; medium acid; gradual, wavy boundary.

B23t—39 to 50 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; weak, coarse, subangular blocky structure; friable; few, thin, brown (7.5YR 4/4) clay films on faces of peds; 5 percent pebbles; slightly acid; clear, wavy boundary.

C—50 to 60 inches, yellowish-brown (10YR 5/4) light sandy loam; massive; friable; 5 percent pebbles; strong effervescence; mildly alkaline.

The solum ranges from 40 to 72 inches in thickness, which coincides with depth to effervescent material. The Ap horizon is slightly acid or neutral. The reaction of the solum below the Ap horizon ranges from strongly acid to neutral. Pebbles and cobbles range from 1 percent to 15 percent throughout the solum.

The Ap horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3). In most places an A2 horizon is present. It is brown (10YR 5/3), pale-brown (10YR 6/3), or yellowish-brown (10YR 5/4, 5/6) sandy loam or loamy sand. In uncultivated areas the A1 horizon is very dark grayish brown (10YR 3/2) and ranges from 2 to 5 inches in thickness, and the A2 horizon is near maximum thickness.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy clay loam, heavy sandy loam, loam, or light clay loam. In some places a B3 horizon occurs. It has colors like those of the B2t horizon and is sandy loam or light sandy clay loam. It contains pockets of sand or loamy sand in some pedons and ranges from 8 to 18 inches in thickness.

The C horizon is yellowish-brown (10YR 5/4), brown (10YR 5/3), or light yellowish-brown (10YR 6/4) sandy loam or loamy sand.

The Riddles soils are generally near Oshtemo and Kidder soils in most landscapes. They have more silt and clay and less sand in the underlying material than the Oshtemo soils. They have a thicker solum than the Kidder soils.

RdB—Riddles sandy loam, 2 to 6 percent slopes. This soil is in broad upland areas and on low rises and side slopes of till plains and moraines. Areas are irregular in shape and range from 10 to about 140 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Miami loam, Kidder sandy loam, Fox sandy loam, Owosso sandy loam, Oshtemo loamy sand, and Conover loam. Some small areas of poorly drained soils, steeper soils, and depressions are identified on the soil map by spot symbols. Small areas of nearly level soils are also included.

The hazard of erosion is slight. Runoff is slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIe–2 (2.5a); woodland group 1o1; woody plant group 4; recreation group 11.

RdC—Riddles sandy loam, 6 to 12 percent slopes. This soil is in broad areas and along streams and drainageways of till plains and moraines. Slopes in the broad areas are short and complex. Areas are irregular in shape and range from 3 to about 60 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is slightly less. The subsurface layer and some yellowish-brown subsoil are incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Kidder sandy loam, Miami loam, Fox sandy loam, Owosso sandy loam, Oshtemo loamy sand, and Conover loam. Some small areas of poorly drained soils, very poorly drained soils, steeper soils, and depressions are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

The hazard of erosion is moderate. Runoff is medium. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIIe–5 (2.5a); woodland group 1o1; woody plant group 4; recreation group 12.

Sebewa Series

The Sebewa series consists of poorly drained and very poorly drained, nearly level soils formed in loamy textured deposits underlain by gravelly sand. These soils are on outwash plains, valley trains, and terraces.

In a representative profile the surface layer is mottled very dark brown loam 11 inches thick. The subsoil is mottled and is 22 inches thick. The upper part is dark-gray, friable loam. The middle part is mottled grayish-brown, yellowish-brown, and strong-brown, firm heavy loam. The lower part is dark-gray, friable heavy loam. The underlying material is mottled grayish-brown gravelly sand.

Sebewa soils have a moderate available water capacity. Permeability is moderate in the solum and rapid in the underlying material.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Sebewa loam, 150 feet north and 1,300 feet west of the southeast corner of SW¼ sec. 32, T. 2 S., R. 5 E., in a cultivated area:

Ap—0 to 11 inches, very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; few, fine, distinct, dark grayish-brown (10YR 4/2) mottles; weak, fine, granular structure; friable; less than 1 percent pebbles; slightly acid; abrupt, smooth boundary.

B21tg—11 to 13 inches, dark-gray (5Y 4/1) loam; common, fine and medium, prominent, yellowish-brown (10YR 5/6, 5/8) mottles; moderate, medium, granular structure; friable; common, moderately thick, very dark gray (5Y 3/1) clay films on faces of peds; less than 1 percent pebbles; neutral; clear, wavy boundary.

B22tg—13 to 26 inches, mottled grayish-brown (10YR 5/2) yellowish-brown (10YR 5/4, 5/6), and strong-brown (7.5YR 5/6) heavy loam; weak, medium, subangular blocky structure; firm; common, moderately thick, dark grayish-brown (10YR 4/2) clay films on faces of peds; 2 percent pebbles; neutral; gradual, wavy boundary.

B23tg—26 to 33 inches, dark-gray (10YR 4/1) heavy loam; common, fine, prominent, yellowish-brown (10YR 5/4, 5/6, 5/8) mottles; weak, medium, subangular blocky structure; friable; few thin clay films on faces of peds; 5 percent pebbles; neutral in the upper part, mildly alkaline in the lower part; abrupt, wavy boundary.

IICg—33 to 60 inches, grayish-brown (10YR 5/2) gravelly sand; many, medium, distinct, brown (10YR 4/3) and yellowish-brown (10YR 5/4) mottles; single grained; loose; 15 percent pebbles; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness, which coincides with depth to effervescent material. The solum is slightly acid to mildly alkaline. Pebbles range from less than 1 percent to 15 percent throughout the solum and from 10 to 60 percent in the underlying material.

The A horizon is very dark brown (10YR 2/2), black (10YR 2/1), or very dark gray (10YR 3/1) and is mottled.

The Bg horizon has a hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2 and is mottled. It is loam, clay loam, or heavy loam.

The IICg horizon is gray (10YR 5/1, 5Y 5/1) or grayish-brown (10YR 5/2) gravelly sand or coarse sand.

The Sebewa soils are generally near Fox, Gilford, and Matherton soils in most landscapes. They differ from the Fox soils in having gray color in the subsoil. They are more gray in the upper part of the subsoil than the Matherton soils. They have more clay in the subsoil than the Gilford soils.

Sb—Sebewa loam. This soil is in depressional areas, broad low-lying areas, and drainageways of outwash plains, valley trains, and terraces. Slope is 0 to 2 percent. Areas are irregular in shape and range from 3 to more than 1,500 acres in size.

Included with this soil in mapping are small areas of Matherton sandy loam, Gilford sandy loam, and Palms muck. Small areas of soils that have a surface layer of organic material as much as 16 inches thick are also included. Some small areas of organic soils are identified on the soil map by a spot symbol.

This soil has a high water table and is too wet for crop production unless drained. Runoff is very slow. Depressional areas are subject to flooding by runoff from adjacent areas.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIw–5 (3c); woodland group 2w1; woody plant group 5; recreation group 7.

Seward Series

The Seward series consists of moderately well drained, gently sloping and sloping soils formed in a thin layer of sandy textured glaciofluvial deposits over clayey textured glacial till or lacustrine deposits. These soils are on lake plains, till plains, the edges of ground moraines, and outwash plains.

In a representative profile the surface layer is dark grayish-brown loamy fine sand 9 inches thick. The subsurface layer is 18 inches of yellowish-brown and pale-brown loamy fine sand. The subsoil is brown, friable heavy sandy loam 5 inches thick. The underlying material is mottled dark-brown clay.

Seward soils have a low available water capacity. Permeability is rapid in the upper part of the soil and slow in the lower part.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Seward loamy fine sand, 2 to 6 percent slopes, 1,180 feet east and 84 feet north of the southwest corner sec. 34, T. 3 S., R. 6 E., in a cultivated area:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, fine, granular structure; very friable; many fine roots; slightly acid; abrupt, smooth boundary.

A21—9 to 22 inches, yellowish-brown (10YR 5/4) loamy fine sand; weak, coarse, granular structure; very friable; common fine roots; medium acid; gradual, wavy boundary.

A22—22 to 27 inches, pale-brown (10YR 6/3) loamy fine sand; single grained; loose; few fine roots; medium acid; gradual, wavy boundary.

B2t—27 to 32 inches, brown (7.5YR 4/4) heavy sandy loam; weak, coarse, subangular blocky structure; friable; neutral; clear, wavy boundary.

IIC—32 to 60 inches, dark-brown (10YR 4/3) clay; few, fine, prominent, yellowish-brown (10YR 5/8) mottles; moderate, medium, angular blocky structure; firm; 3 percent pebbles; slight effervescence; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness, which coincides with depth to effervescent material. The upper part of the solum is medium acid to neutral and the lower part is neutral or mildly alkaline.

The Ap horizon is dark grayish-brown (10YR 4/2) or very dark grayish-brown (10YR 3/2) loamy fine sand or loamy sand. The A2 horizon, if present, has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. The lower part of the A2 horizon has mottles in some pedons. This horizon is loamy sand, loamy fine sand, or sand. In uncultivated areas the A1 horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3) and has texture like that of the Ap horizon, and the A2 horizon is near maximum thickness.

In some pedons a B1 horizon is present. It is yellowish brown (10YR 5/4) or light yellowish brown (10YR 6/4) and has mottles in some pedons. It is loamy fine sand or fine sand. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4 and has mottles in many pedons. It is heavy sandy loam or fine sandy loam.

The IIC horizon is dark brown (10YR 4/3), yellowish brown (10YR 5/4, 5/6), or brown (7.5YR 4/4) and has mottles in many pedons. It is silty clay or clay.

The Seward soils are generally near St. Clair and Ypsi soils in most landscapes. They have more sand in the solum than the St. Clair soils. They lack the gray in the subsoil characteristic of the Ypsi soils.

SeB—Seward loamy fine sand, 2 to 6 percent slopes. This soil is mainly on the tops and sides of low ridges and in broad upland areas of lake plains, till plains, and outwash plains. Areas are irregular in shape and range from 3 to about 40 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Spinks loamy sand, St. Clair clay loam, and Ypsi sandy loam. Some small areas of poorly drained and steeper soils are identified on the soil map by spot symbols. Small areas of nearly level soils are also included.

This soil is subject to soil blowing if cultivated. Runoff is slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIIs–1 (4/1a); woodland group 1o1; woody plant group 4; recreation group 3.

SeC—Seward loamy fine sand, 6 to 12 percent slopes. This soil is on sides of ridges, areas that have short complex slopes, and along streams and drainageways of lake plains, till plains, ground moraines, and outwash plains. Areas are irregular in shape and range from 3 to about 30 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is slightly less. Some yellowish-brown subsurface soil is incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Spinks loamy sand, St. Clair clay loam, and Ypsi sandy loam. Some small areas of poorly drained, very poorly drained, and steeper soils are identified on the soil map by spot symbols. Small areas of gently sloping soils are also included.

The hazard of erosion is moderate. Soil blowing is a hazard in cultivated areas. Runoff is slow. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIIe–3 (4/1a); woodland group 1o1; woody plant group 4; recreation group 4.

Seward Variant

The Seward variant consists of moderately well drained, gently sloping soils formed in a thin layer of sandy and loamy textured glaciofluvial deposits over clayey textured glacial till or lacustrine deposits. These soils are on lake plains, ground moraines, and till plains.

In a representative profile the surface layer is dark grayish-brown sandy loam 10 inches thick. The subsurface layer is 4 inches of yellowish-brown loamy sand. The subsoil is 14 inches thick. The upper part is dark yellowish-brown, friable sandy loam. The middle part is dark yellowish-brown, friable sandy clay loam. The lower part is brown, firm clay. The underlying material is mottled brown clay.

The Seward variant has a moderate available water capacity. Permeability is moderately rapid in the loamy upper layers and slow in the clayey lower layers.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Seward sandy loam, loamy subsoil variant, 2 to 6 percent slopes, 410 feet west and 600 feet north of the southeast corner sec. 16, T. 4 S., R. 6 E., in a cultivated area:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, medium, subangular blocky structure parting to moderate, medium, crumb; friable; neutral; abrupt, smooth boundary.

A2—10 to 14 inches, yellowish-brown (10YR 5/4) loamy sand; weak, medium, subangular blocky structure; very friable; dark grayish-brown (10YR 4/2) root channels; neutral; clear, irregular boundary.

B21t—14 to 20 inches, dark yellowish-brown (10YR 4/4) sandy loam; moderate, medium, subangular blocky structure; friable; continuous, thin clay films on faces of peds; dark grayish-brown (10YR 4/2) root channels; neutral; clear, smooth boundary.

B22t—20 to 24 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; moderate, medium, subangular blocky structure; friable; continuous, thin, brown (10YR 4/3) clay films on faces of peds; neutral; abrupt, irregular boundary.

IIB3—24 to 28 inches, brown (10YR 5/3) clay; strong, fine and medium, angular blocky structure; firm; mildly alkaline; abrupt, wavy boundary.

IIC—28 to 60 inches, brown (10YR 5/3) clay; many, fine, distinct, yellowish-brown (10YR 5/8) and gray (10YR 6/1) mottles; massive; firm; violent effervescence; mildly alkaline.

The solum ranges from 20 to 40 inches in thickness, which coincides with depth to effervescent material. The solum is medium acid to mildly alkaline.

The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). The A2 horizon is yellowish brown (10YR 6/4). It is absent in some pedons. It is sandy loam or loamy sand. In uncultivated areas the A1 horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3), and the A2 horizon is near maximum thickness.

In some pedons a B1 horizon is present. It has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is sandy loam, or loamy sand. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is sandy loam or sandy clay loam. The IIB horizon has colors like those of the B2t horizon and is mottled in some pedons. It is silty clay, clay, silty clay loam, or clay loam.

The IIC horizon is brown (10YR 5/3), or grayish brown (10YR 5/2), pale brown (10YR 6/3), or light yellowish brown (10YR 6/4) and has mottles in many pedons. It is silty clay or clay.

The Seward variant soils are generally near St. Clair and Ypsi soils in most landscapes. They have more sand in the upper part of the solum than the St. Clair soils. They lack the gray in the subsoil characteristic of the Ypsi soils.

SfB—Seward sandy loam, loamy subsoil variant, 2 to 6 percent slopes. This soil is on the tops and sides of low beach ridges and in broad upland areas of lake plains, ground moraines, and till plains. Areas are irregular in shape and range from 3 to about 200 acres in size.

Included with this soil in mapping are small areas of Boyer loamy sand, Owosso sandy loam, St. Clair clay loam, Ypsi sandy loam, and Metamora sandy loam. Some small areas of poorly drained and steeper soils are identified on the soil map by spot symbols. Small areas of nearly level soils are also included.

The hazard of erosion is slight. Runoff is slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIe–2 (3/1a); woodland group 1o1; woody plant group 4; recreation group 17.

Sisson Series

The Sisson series consists of well-drained, gently sloping to sloping soils formed in stratified deposits that have alternating layers of sandy to loamy textured sediments. These soils are on lake plains and outwash plains.

In a representative profile the surface layer is dark grayish-brown fine sandy loam 9 inches thick. The subsurface layer is 5 inches of brown fine sandy loam. The subsoil is 23 inches thick. The upper part is yellowish-brown, friable heavy fine sandy loam. The middle part is yellowish-brown, firm clay loam. The lower part is dark yellowish-brown, friable heavy very fine sandy loam and firm clay loam. The underlying material is stratified brown silt loam and yellowish-brown very fine sand.

Sisson soils have a high available water capacity. Permeability is moderate.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Sisson fine sandy loam, 2 to 6 percent slopes, 785 feet east and 700 feet north of the southwest corner of the NW¼ sec. 7, T. 4 S., R. 7 E., in a cultivated area:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, medium, subangular blocky structure; very friable; slightly acid; abrupt, smooth boundary.

A2—9 to 14 inches, brown (10YR 5/3) fine sandy loam; weak, medium, platy structure parting to weak, very fine, subangular blocky; very friable; slightly acid; clear, irregular boundary.

B&A—14 to 17 inches, yellowish-brown (10YR 5/6) heavy fine sandy loam (B part) and brown (10YR 5/3) fine sandy loam (A part); coatings 2 to 5 millimeters thick on faces of peds (less than 15 percent by volume); moderate medium, subangular blocky structure; friable; neutral; clear, irregular boundary.

B21t—17 to 22 inches, yellowish-brown (10YR 5/6) heavy fine sandy loam; moderate, medium, subangular blocky structure; friable; common, thin clay films on faces of peds; neutral; clear, smooth boundary.

B22t—22 to 30 inches, yellowish-brown (10YR 5/6) clay loam; moderate, medium, subangular blocky structure; firm; common, moderately thick, brown (7.5YR 4/4) clay films on faces of peds; few, fine, distinct, dark-brown (7.5YR 3/2) segregations; slightly acid; clear, wavy boundary.

B31—30 to 34 inches, dark yellowish-brown (10YR 4/4) heavy very fine sandy loam; weak, medium, subangular blocky structure; friable; slightly acid; abrupt, wavy boundary.

B32—34 to 37 inches, dark yellowish-brown (10YR 4/4) clay loam; weak, medium, subangular blocky structure; firm; slight effervescence; mildly alkaline; abrupt, wavy boundary.

C—37 to 60 inches, stratified brown (10YR 5/3) silt loam and yellowish-brown (10YR 5/4) very fine sand; massive; friable and very friable; strong effervescence; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness, which coincides with depth to effervescent material. The solum is slightly acid to mildly alkaline. Pebble content is less than 1 percent throughout the solum.

The Ap horizon is dark-brown (10YR 4/3) or dark grayish-brown (10YR 4/2) fine sandy loam, sandy loam, or loamy fine sand. The A2 horizon is pale-brown (10YR 6/3) or brown (10YR 5/3) fine sandy loam, sandy loam, or loam. It is absent in some pedons. In uncultivated areas the A1 horizon is very dark grayish brown (10YR 3/2), and the A2 horizon is near maximum thickness.

In some pedons a B1 horizon is present. It is yellowish brown (10YR 5/4) and has texture like that of the A2 horizon. In some places thin coatings of material from the A2 horizon are on the face of peds in the B1 horizon. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam, heavy fine sandy loam, heavy silt loam, sandy clay loam, or clay loam. The B3 horizon has colors like those of the B2t horizon and is very fine sandy loam, sandy loam or clay loam. It is absent in some pedons.

The C horizon is light brownish-gray (10YR 6/2), pale-brown (10YR 6/3), light yellowish-brown (10YR 6/4), brown (10YR 5/3), or yellowish-brown (10YR 5/4, 5/6) stratified silt loam, very fine sandy loam, fine sand, silt, very fine sand, and loamy very fine sand.

The Sisson soils are generally near Spinks, Kibbie, Dixboro, and Colwood soils in most landscapes. They lack the gray color in the subsoil characteristic of the Kibbie, Dixboro, and Colwood soils. They have more clay in the subsoil than the Dixboro and Spinks soils.

SnB—Sisson fine sandy loam, 2 to 6 percent slopes. This soil is on lake plains and outwash plains. Slopes are long and uniform or short and complex. Areas are irregular in shape and range from 3 to about 100 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Kibbie fine sandy loam, Dixboro fine sandy loam, Morley loam, Colwood loam, Miami loam, and Spinks loamy sand. Small areas of moderately well drained soils are also included. Some small areas of poorly drained and steeper soils are identified on the soil map by spot symbols. Small areas of nearly level soils are also included.

The hazard of erosion is slight. Runoff is slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIe–2 (2.5a); woodland group 1o1; woody plant group 4; recreation group 11.

SnC—Sisson fine sandy loam, 6 to 12 percent slopes. This soil is on lake plains and outwash plains. Slopes are uniform or short and complex. Areas are irregular in shape and range from 3 to about 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is slightly less. The subsurface layer and some yellowish-brown subsoil are incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Spinks loamy sand, Kibbie fine sandy loam, Dixboro fine sandy loam, Morley loam, and Miami loam. Small areas of moderately well drained soils and small areas of gently sloping soils are also included. Some small areas of poorly drained, very poorly drained, and steeper soils are identified on the soil map by spot symbols.

The hazard of erosion is moderate. Runoff is medium. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIIe–5 (2.5a); woodland group 1o1; woody plant group 4; recreation group 12.

Sloan Series

The Sloan series consists of very poorly drained, nearly level soils formed in stratified loamy textured alluvial deposits. These soils are on the flood plains of streams and rivers.

In a representative profile the surface layer is very dark grayish brown silt loam 13 inches thick. The subsoil is mottled and is 25 inches thick. The upper part is dark grayish-brown, friable stratified silt loam and fine sandy loam. The middle part is very dark grayish-brown, firm light clay loam. The lower part is dark grayish-brown, firm heavy loam. The upper 10 inches of the underlying material is mottled dark grayish-brown heavy loam, and below this is dark-gray sandy loam.

Sloan soils have a high available water capacity. Permeability is moderate.

Most of the acreage is used for wildlife, woodland, and permanent pasture. Some small areas are in crops.

Representative profile of Sloan silt loam, wet, 710 feet north and 360 feet west of the southeast corner of the NE¼ sec. 33, T. 4 S., R. 6 E., in a cultivated area:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, subangular blocky structure; friable; many fine roots; strong effervescence; mildly alkaline; abrupt, smooth boundary.

A12—10 to 13 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, subangular blocky structure; friable; common fine roots; strong effervescence; mildly alkaline; clear, smooth boundary.

B1g—13 to 18 inches, dark grayish-brown (10YR 4/2) stratified silt loam and fine sandy loam; few, fine, faint, dark yellowish-brown (10YR 4/4) mottles; weak, fine, subangular blocky structure; friable; common fine roots; strong effervescence; mildly alkaline; abrupt, smooth boundary.

B21t—18 to 31 inches, very dark grayish-brown (10YR 3/2) light clay loam; few, fine, faint, dark yellowish-brown (10YR 4/4) mottles; moderate, medium, subangular blocky structure; firm; strong effervescence; mildly alkaline; clear, smooth boundary.

B22g—31 to 38 inches, dark grayish-brown (10YR 4/2) heavy loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; firm; strong effervescence; mildly alkaline; gradual, smooth boundary.

C1g—38 to 48 inches, dark grayish-brown (10YR 4/2) heavy loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; friable; slight effervescence; mildly alkaline; gradual, smooth boundary.

C2g—48 to 60 inches, dark-gray (10YR 4/1) sandy loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; very friable; slight effervescence; mildly alkaline.

Reaction of the profile ranges from neutral to moderately alkaline and effervescence ranges from none to violent. Small amounts of pebbles, less than 5 percent by volume, are present in some pedons.

The A horizon is very dark grayish-brown (10YR 3/2), very dark brown (10YR 2/2), or very dark gray (10YR 3/1) silt loam or loam.

The B horizon is grayish-brown (10YR 5/2), gray (10YR 5/1), light brownish-gray (10YR 6/2), very dark grayish-brown (10YR 3/2), or dark grayish-brown (10YR 4/2) sandy clay loam, clay loam, silt loam, or loam. Thin strata of sandy loam or fine sandy loam are in some pedons.

The Cg horizon is stratified, and texture is variable.

The depth to effervescent material is less than is typical for the series. This difference does not significantly affect use and management.

The Sloan soils are generally near Cohoctah soils in most landscapes. They contain more clay than the Cohoctah soils.

So—Sloan silt loam, wet. This soil is on alluvial flood plains of streams and rivers. Areas are elongated. Slope is 0 to 2 percent. Areas range from 5 to 250 acres in size.

Included with this soil in mapping are many small areas of Cohoctah fine sandy loam. Small areas of Sebawa loam, Pella silt loam, Gilford sandy loam, organic soils, and somewhat poorly drained soils are also included.

This soil has a high water table and is subject to flooding. It is too wet for crop production unless drained and protected from flooding. Runoff is slow or very slow.

Most of the acreage is used for wildlife, woodland, and permanent pasture. Some small areas are in crops. Capability unit Vw–1 (L–2c); woodland group 2w1; woody plant group 5; recreation group 8.

Spinks Series

The Spinks series consists of well-drained, nearly level to steep soils formed in sandy textured deposits. These soils are in pitted outwash areas and on outwash plains, valley trains, terraces, and moraines.

In a representative profile the surface layer is dark grayish-brown loamy sand 10 inches thick. The subsoil is 75 inches thick. The upper part is yellowish-brown, very friable loamy sand. The lower part is pale-brown, loose fine sand that has bands of dark-brown, friable loamy fine sand. The underlying material is yellowish-brown fine sand.

Spinks soils have a low available water capacity. Permeability is moderately rapid and rapid.

Gently sloping areas are used for crops. Some areas are used for woodland, recreation, or urban development. Strongly sloping areas are used for recreation, woodland, and wildlife. Some small areas are mined for sand.

Representative profile of Spinks loamy sand, 0 to 6 percent slopes, 520 feet north and 100 feet east of the southwest corner sec. 22, T. 2 S., R. 5 E., in a cultivated area:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) loamy sand; weak, medium, granular structure; very friable; many fine roots; slightly acid; abrupt, smooth boundary.

B—10 to 22 inches, yellowish-brown (10YR 5/4) loamy sand; weak, fine, granular structure; very friable; common fine roots; slightly acid; abrupt, wavy boundary.

A2&Bt—22 to 85 inches, pale-brown (10YR 6/3) fine sand

(A2); single grained; loose; lamellae and bands of dark-brown (7.5YR 4/4) loamy fine sand (Bt); weak, fine, subangular blocky structure; friable; common fine roots in upper part, few in lower part; neutral; clear, wavy boundary.

C—85 to 105 inches, yellowish-brown (10YR 5/4) fine sand; single grained; loose; slight effervescence; mildly alkaline.

The solum ranges from 36 inches to many feet in thickness. It typically ranges from medium acid to neutral, but many pedons are mildly alkaline in the lower part of the A2&Bt horizon. Pebbles range from 0 to 15 percent throughout the profile.

The Ap horizon is dark grayish-brown (10YR 4/2), dark yellowish-brown (10YR 4/4), brown (10YR 5/3), grayish-brown (10YR 5/2), or dark-brown (10YR 3/3, 4/3) loamy sand, loamy fine sand, or sand.

The B horizon is yellowish-brown (10YR 5/4, 5/6), dark yellowish-brown (10YR 4/4), light yellowish-brown (10YR 6/4), or brownish-yellow (10YR 6/6) loamy sand, fine sand, or sand. The A2 part of the A2&Bt horizon is pale-brown (10YR 6/3), brown (10YR 5/3), yellowish-brown (10YR 5/4, 5/6), or light yellowish-brown (10YR 6/4) loamy sand, fine sand, or sand. The Bt part of the A2&Bt horizon is dark brown (7.5YR 4/4), dark yellowish brown (10YR 5/6), or strong brown (7.5YR 5/6). The individual bands or lamella of the Bt part range from sand to light sandy loam, but the weighted average clay content of the combined bands is within the loamy sand textural class. The bands range from ⅛ to 5 inches thick, are often discontinuous, are spaced 5 to 10 inches apart, and have an accumulative thickness of more than 6 inches. Depth to the first band of the Bt horizon ranges from 15 to about 36 inches.

The C horizon is yellowish-brown (10YR 5/4), light yellowish-brown (10YR 6/4), brown (10YR 5/3), pale-brown (10YR 6/3), or very pale brown (10YR 7/3) fine sand or sand.

The Spinks soils are generally near Oshtemo, Thetford, Oakville, and Sisson soils in most landscapes. They contain less clay and less gravel than the Oshtemo soils. They lack the gray color in the subsoil of the Thetford soils. They have bands of clay accumulation in the subsoil, which do not occur in the subsoil of Oakville soils. They have less clay in the subsoil than the Sisson soils.

SpB—Spinks loamy sand, 0 to 6 percent slopes. This soil is on broad uplands of outwash plains, pitted outwash areas, valley trains, terraces, and moraines. Slopes are uniform or short and complex. Areas are irregular in shape and range from 3 to about 400 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Oshtemo loamy sand, Boyer loamy sand, Thetford loamy fine sand, Oakville fine sand, and Seward loamy fine sand. Also included are small areas of soils that have less than 6 inches of loamy sand bands in the subsoil. Also included and identified on the soil map by spot symbols are some small areas of poorly drained and steeper soils.

This Spinks soil is droughty and is subject to soil blowing when cultivated. Runoff is slow or very slow.

Most of the acreage is used for crops. Some areas are used for woodland, recreation, or urban development. Some small areas are mined for sand. Capability unit IIIs–1 (4a); woodland group 2s5; woody plant group 3; recreation group 3.

SpC—Spinks loamy sand, 6 to 12 percent slopes. This soil is on terraces and moraines and in valley trains and pitted outwash areas. Slopes are uniform or short and complex. Areas are irregular in shape and range from 3 to about 100 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is significantly less.

Included with this soil in mapping are small areas of Oshtemo loamy sand, Boyer loamy sand, Thetford loamy fine sand, Oakville fine sand, and Seward loamy fine sand. Also included are small areas of soils that are less than 6 inches of loamy sand bands in the subsoil and small areas of gently sloping soils. Also included and identified on the soil map by spot symbols, are some small areas of poorly drained soils, very poorly drained soils, steeper soils, and depressions.

The hazard of erosion is moderate. The soil is also droughty and subject to soil blowing when cultivated. Runoff is slow. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for woodland or crops. Some areas of this soil are used for recreation or are mined for sand. Capability unit IIIe–3 (4a); woodland group 2s5; woody plant group 3; recreation group 4.

SpD—Spinks loamy sand, 12 to 18 percent slopes. This soil is in pitted outwash areas and along streams and drainageways. Areas are irregular in shape and range from 3 to about 80 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is significantly less.

Included with this soil in mapping are small areas of Oshtemo loamy sand, Boyer loamy sand, Thetford loamy fine sand, Oakville fine sand, Kidder sandy loam, and Miami loam. Small areas of less sloping soils are also included. Also included are small areas of soils that have less than 6 inches of loamy sand bands in the subsoil and many small areas of severely eroded soils that are less than 36 inches deep over the underlying material. Also included and identified on the soil map by spot symbols are some small areas of wet depressional soils, steeper soils, and depressions.

The hazard of erosion is severe. This soil is also droughty and subject to soil blowing when cultivated. Runoff is medium. Complex slopes make tillage difficult.

Most of the acreage is used for woodland, permanent pasture, and recreation. Some small areas are used for crops or are mined for sand. Capability unit IVe–3 (4a); woodland group 2s5; woody plant group 3; recreation group 5.

SpE—Spinks loamy sand, 18 to 25 percent slopes. This soil is in pitted outwash areas and along streams and drainageways. Areas are irregular in shape and range from 3 to more than 200 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is significantly less. Many areas also have a thinner, darker colored surface layer.

Included with this soil in mapping are small areas of Oshtemo loamy sand, Boyer loamy sand, Oakville fine sand, Kidder sandy loam, and Miami loam. Also included are small areas of moderately steep and very steep soils, small areas of soils that have less than 6 inches of loamy sandy bands in the subsoil, and many small areas of severely eroded soils that are less than 36 inches deep over the underlying material. Also included and identified on the soil map by spot symbols are some small areas of wet depressional soils and depressions.

The hazard of erosion is very severe. This soil is also droughty and subject to soil blowing. Runoff is rapid.

Figure 13.—Sprinkler irrigation of tomatoes on Spinks-Oshtemo loamy sand, 0 to 6 percent slopes.

Most of the acreage is used for recreation, woodland, and wildlife. Some areas are used for permanent pasture or are mined for sand. Capability unit VIe–2 (4a); woodland group 2s6; woody plant group 3; recreation group 5.

SrB—Spinks-Oshtemo loamy sands, 0 to 6 percent slopes. This mapping unit is on broad uplands on outwash plains, in valley trains, and on moraines. Slopes are uniform in some areas and short and complex in others. Areas range from 3 to about 160 acres in size.

Spinks soils make up about 45 percent of the acreage, and Oshtemo soils make up about 30 percent. The Oshtemo soils have the profile described as representative of the Oshtemo series.

Included with this unit in mapping and making up about 25 percent of the acreage, are small areas of Boyer loamy sand, Oakville fine sand, Fox sandy loam, Thetford loamy sand, and Wasepi sandy loam. Also included and identified on the soil map by spot symbols are some small areas of poorly drained and steeper soils.

This unit is droughty and subject to soil blowing when cultivated. Runoff is slow and very slow.

Most of the acreage is used for crops. Some small areas are irrigated and used for truck crops (fig. 13) and small fruit. Some small areas are in urban uses. Capability unit IIIs–1 (4a); woodland group 2s5; woody plant group 3; recreation group 3.

St. Clair Series

The St. Clair series consists of well drained and moderately well drained, gently sloping to very steep soils formed in clayey textured glacial till. These soils are on till plains and moraines.

In a representative profile the surface layer is dark-brown clay loam about 9 inches thick. The subsoil is 16 inches of firm clay. The upper part is yellowish brown, the next part is brown, and the lower part is dark brown. The underlying material is brown clay.

St. Clair soils have a moderate available water capacity. Permeability is slow or very slow.

Most of the acreage is used for crops. Small areas are under urban development or are in woodland. Steep areas are used for woodland, permanent pasture, and wildlife.

Representative profile of St. Clair clay loam, 2 to 6 percent slopes, 375 feet north and 72 feet west of the southeast corner of NE¼ sec. 2, T. 2 S., R. 7 E., in a cultivated area:

Ap—0 to 9 inches, dark-brown (10YR 4/3) clay loam; moderate, medium, granular structure; friable; less than 1 percent pebbles; many fine roots; slightly acid; abrupt, smooth boundary.

B1—9 to 12 inches, yellowish-brown (10YR 5/4) clay; common, medium, faint, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; many, thin clay films in root chan-

nels: less than 1 percent pebbles; dark-brown (10YR 4/3) worm casts; many fine roots; medium acid; clear, wavy boundary.

B21t—12 to 18 inches, brown (10YR 5/3) clay; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, medium, angular blocky structure; firm; many, thin, yellowish-brown (10YR 5/4) clay films on faces of peds; less than 1 percent pebbles; few fine roots; medium acid; gradual, wavy boundary.

B22t—18 to 25 inches, dark-brown (10YR 4/3) clay; common, medium, faint, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) mottles; moderate, medium, angular blocky structure; firm; many, thin clay films on faces of peds; less than 1 percent pebbles; few fine roots; neutral; abrupt, wavy boundary.

C—25 to 60 inches, brown (10YR 5/3) clay; common, medium, faint, yellowish-brown (10YR 4/4) mottles; strong, medium, angular blocky structure; firm; 1 percent pebbles; light-gray (10YR 7/2) lime streaks; strong effervescence; mildly alkaline.

The solum ranges from 20 to 30 inches in thickness, which coincides with depth to effervescent material. The solum is medium acid to neutral. Pebbles and cobbles range from less than 5 percent to 15 percent throughout the profile.

The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 4/3, 3/3), or very dark grayish brown (10YR 3/2) moist. It is clay loam or loam. In some places an A2 horizon is present. It is pale-brown (10YR 6/3) clay loam, silt loam, or loam. In uncultivated areas the A1 horizon is very dark gray (10YR 3/1) clay loam or loam, and the A2 horizon is near maximum thickness.

The B1 horizon is brown (10YR 4/3) or yellowish brown (10YR 5/4) and is mottled in many pedons. It is clay or clay loam. The B1 horizon is absent in some pedons. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4 and is mottled. It is silty clay or clay.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4 and is mottled. It is silty clay or clay.

The St. Clair soils are generally near Nappanee, Hoytville, and Seward soils in most landscapes. St. Clair soils lack the gray color in the subsoil characteristic of the Nappanee and Hoytville soils. They have less sand in the solum than the Seward soils.

StB—St. Clair clay loam, 2 to 6 percent slopes. This soil is in broad upland areas and on low rises and side slopes of till plains and moraines. Areas are irregular in shape and range from 3 to more than 500 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Nappanee silty clay loam, Morley loam, Blount loam, and Pewamo clay loam. Some small areas of Seward loamy fine sand, Seward sandy loam, loamy subsoil variant, and Spinks loamy sand are included and are identified on the soil map by spot symbols. Small areas of poorly drained and steeper soils are also identified by spot symbols. Small areas of soils that are less than 20 inches deep over the underlying material, and small areas of nearly level soils are also included.

The hazard of erosion is moderate, and this soil is wet during the spring because permeability is very slow. Runoff is medium.

Most of the acreage is used for crops. Some large areas are under urban development. Some small areas are in woodland. Capability unit IIIe–1 (1a); woodland group 2c1; woody plant group 2; recreation group 21.

StC—St. Clair clay loam, 6 to 12 percent slopes. This soil is in broad areas and along streams and drainageways of till plains and moraines. Slopes in the broad areas are short and complex. Some areas are long and narrow, and some are irregular in shape. They range from 3 to about 300 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to underlying material is slightly less. Some yellowish-brown subsoil is incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Nappanee silty clay loam, Morley loam, and Blount loam. Some small areas of Seward loamy fine sand, Seward sandy loam, loamy subsoil variant, and Spinks loamy sand are included and are identified on the soil map by spot symbols. Small areas of poorly drained, very poorly drained, and steeper soils are also identified by spot symbols. Some small areas of severely eroded soils and small areas of gently sloping soils are also included.

The hazard of erosion is severe. Runoff is rapid. Complex slopes make tillage somewhat difficult.

Most of the acreage is used for crops. Small areas are under urban development or are in woodland. Capability unit IIIe–2 (1a); woodland group 2c1; woody plant group 2; recreation group 22.

StD—St. Clair clay loam, 12 to 18 percent slopes. This soil is in broad areas and along streams and drainageways of till plains and moraines. Slopes in the broad areas are short and complex. Most areas are long and narrow, but some are irregular in shape. They range from 3 to about 200 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is less. Some yellowish-brown or brown subsoil is incorporated into the surface layer in cultivated areas.

Included with this soil in mapping are small areas of Nappanee silty clay loam and Morley loam. Some small areas of Seward loamy fine sand, Seward sandy loam, loamy subsoil variant, and Spinks loamy sand are included and are identified on the soil map by spot symbols. Small areas of wet depressional soils and steeper soils are also identified by spot symbols. Many small areas of severely eroded soils, and small areas of sloping soils are also included.

The hazard of erosion is severe. Runoff is very rapid. Complex slopes make tillage difficult.

Most of the acreage is used for crops, permanent pasture, and woodland. Capability unit IVe–1 (1a); woodland group 2c1; woody plant group 2; recreation group 22.

StE—St. Clair clay loam, 18 to 35 percent slopes. This soil is along streams and drainageways and in broad areas of till plains and moraines. Slopes in the broad areas are short and complex. Most areas are long and narrow, but some are irregular in shape. They range from 3 to about 100 acres in size.

This soil has a profile similar to the one described as representative of the series, but depth to the underlying material is less. Many areas also have a thinner, darker colored surface layer and a light-colored subsurface layer that are not characteristic of the soil described as typical.

Included with this soil in mapping, and identified on the soil map by spot symbols, are some small areas of Seward loamy sand, Fox sandy loam, and Spinks loamy

sand. Small areas of wet depressional soils are also identified by spot symbols. Many small areas of severely eroded soils and small areas of moderately steep and very steep soils are also included.

The hazard of erosion is very severe. Runoff is very rapid.

Most of the acreage is used for woodland and wildlife. Some small areas are in permanent pasture. Capability unit VIe–1 (1a); woodland group 2c2; woody plant group 2; recreation group 23.

Tedrow Series

The Tedrow series consists of somewhat poorly drained, nearly level and gently sloping soils formed in sandy textured glaciofluvial or lacustrine deposits. These soils are on lake plains, outwash plains, and beach ridges.

In a representative profile the surface layer is dark grayish-brown loamy fine sand 8 inches thick. The subsoil is 38 inches of loose fine sand. The upper part is brownish yellow, the next part is yellowish brown, and the lower part is mottled light yellowish brown. The underlying material is mottled pale-brown fine sand.

Tedrow soils have a low available water capacity. Permeability is rapid.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Tedrow loamy fine sand, 0 to 4 percent slopes, 340 feet west and 2,500 feet south of the northeast corner sec. 36, T. 4 S., R. 7 E., in a cultivated area:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, fine, granular structure; very friable; common fine roots; medium acid; abrupt, smooth boundary.

B21—8 to 16 inches, brownish-yellow (10YR 6/6) fine sand; single grained; loose; few fine roots; slightly acid; gradual, wavy boundary.

B22—16 to 25 inches, yellowish-brown (10YR 5/6) fine sand; single grained; loose; few fine roots; slightly acid; clear, wavy boundary.

B23—25 to 34 inches, light yellowish-brown (10YR 6/4) fine sand; common, medium, distinct, strong-brown (7.5YR 5/6) and few, medium, distinct, grayish-brown (10YR 5/2) mottles; single grained; loose; very few fine roots; slightly acid; clear, wavy boundary.

B3—34 to 46 inches, light yellowish-brown (10YR 6/4) fine sand; few, fine, faint, yellowish-brown (10YR 5/6) and common, medium, distinct, gray (10YR 6/1) mottles; single grained; loose; neutral, gradual, wavy boundary.

C—46 to 60 inches, pale-brown (10YR 6/3) fine sand; common, medium, faint, gray (10YR 6/1) mottles; single grained; loose; slight effervescence, moderately alkaline.

The solum ranges from 30 to 50 inches in thickness. It is medium acid to neutral.

The Ap horizon is dark grayish-brown (10YR 4/2) or very dark grayish-brown (10YR 3/2) loamy fine sand, fine sand, or loamy sand.

The B horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6, and is mottled. It is fine sand, sand, loamy fine sand, or loamy sand.

The C horizon is pale brown (10YR 6/3), brown (10YR 5/3), or light brownish gray (10YR 6/2) and is mottled. It is fine sand or sand.

The Tedrow soils in most landscapes are near the Oakville, Thetford, and Granby soils. They are gray in the subsoil, whereas the Oakville soils are brown. They lack the bands of clay accumulation in the subsoil which are characteristic of the Thetford soils. They are less gray in the subsoil than the Granby soils.

TeA—Tedrow loamy fine sand, 0 to 4 percent slopes. This soil is in broad low-lying areas, along drainageways of lake plains or outwash plains, and along bottoms of beach ridges. Areas are irregular in shape and range from 3 to 300 acres in size.

Included with this soil in mapping are small areas of Oakville fine sand, Thetford loamy fine sand, and Granby fine sand. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols.

This soil has a seasonal high water table. If cleared and drained, it is subject to soil blowing and is droughty during the summer. Runoff is slow or very slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIIw–4 (5b); woodland group 3s3; woody plant group 2; recreation group 24.

Thetford Series

The Thetford series consists of somewhat poorly drained, nearly level and gently sloping soils formed in sandy textured deposits. These soils are on moraines, till plains, lake plains, outwash plains, and beach ridges.

In a representative profile the surface layer is dark-brown loamy sand 9 inches thick. The subsoil is 29 inches thick. The upper part is yellowish-brown, very friable loamy sand. The lower part is mottled pale-brown, loose sand that has bands of dark yellowish-brown and dark-brown, friable heavy loamy sand and light sandy loam. The underlying material is brown sand.

Thetford soils have a low available water capacity. Permeability is moderately rapid.

Most of the acreage is used for crops. Some small areas are in woodland or are mined for sand.

Representative profile of Thetford loamy sand, 0 to 4 percent slopes, 275 feet west and 1,050 feet north of southeast corner of the SW¼ sec. 32, T. 3 S., R. 7 E., in a cultivated area:

Ap—0 to 9 inches, dark-brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak, medium, granular structure; very friable; few roots; strongly acid; abrupt, smooth boundary.

B2—9 to 20 inches, yellowish-brown (10YR 5/4) loamy sand; weak, medium, subangular blocky structure; very friable; strongly acid; gradual, smooth boundary.

A2&Bt—20 to 38 inches, pale-brown (10YR 6/3) sand (A2); single grained; loose; lamellae and bands of dark yellowish-brown (10YR 4/4) and dark-brown (7.5YR 4/4) heavy loamy sand and light sandy loam (Bt); few, medium, distinct, strong-brown (7.5YR 5/6) and common, fine, distinct, grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; bands are 1 to 3 inches thick, spaced 1 to 5 inches apart, and have a combined thickness of 8 inches; clay bridges connect sand grains and few, thin clay films are on faces of peds in bands; slightly acid; abrupt, wavy boundary.

C—38 to 60 inches, brown (10YR 5/3) sand; single grained; loose; slight effervescence; mildly alkaline.

The solum ranges from 30 to 60 inches in thickness, which coincides with depth to effervescent material. The solum is medium acid to neutral.

The Ap horizon is dark brown (10YR 3/3), dark grayish brown (10YR 4/2), or very dark grayish brown (10YR 3/2). In uncultivated areas the A1 horizon is very dark grayish-brown loamy fine sand.

The upper part of the B horizon is yellowish brown (10YR 5/4, 5/6), light yellowish brown (10YR 6/4), dark yellowish brown (10YR 4/4), or dark brown (10YR 4/3) and is mottled in many pedons. It is sand or loamy sand. The A2 part of the A2&Bt horizon has hue of 10YR, value of 6 to 8, and chroma of 2 or 3, and is mottled. It has texture like that of the upper part of the B horizon. The Bt part of the A2&Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4, and is mottled. The individual bands or lamella of the Bt part are loamy sand or sandy loam. The bands range from ½ to 3 inches in thickness, are often discontinuous, are spaced from 1 to 6 inches apart, and have an accumulative thickness of more than 6 inches.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4, and is mottled in most pedons.

The Thetford soils are generally near the Spinks, Gilford, and Tedrow soils in most landscapes. They differ from the Spinks soils in having gray color in the subsoil. They are less gray in the subsoil than the Gilford soils. They differ from Tedrow soils in having bands of loamy sand or sandy loam.

ThA—Thetford loamy sand, 0 to 4 percent slopes. This soil is in depressional areas, on broad low-lying areas, and along drainageways of moraines, till plains, lake plains, outwash plains, and beach ridges. Areas are irregular in shape and range from 3 to about 80 acres in size.

Included with this soil in mapping are small areas of Tedrow loamy fine sand, Spinks loamy sand, Gilford sandy loam, and Granby fine sand. Small areas of soils where loamy or clayey material is at a depth of 50 to 60 inches are also included. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols.

This soil has a seasonal high water table. If drained, it has the tendency to be droughty during the summer. Runoff is slow or very slow.

Most of the acreage is used for crops. Some small areas are in woodland or are mined for sand. Capability unit IIIw–4 (4b); woodland group 3s3; woody plant group 2; recreation group 24.

Wasepi Series

The Wasepi series consists of somewhat poorly drained, nearly level and gently sloping soils formed in loamy textured deposits underlain by gravelly sand. These soils are on outwash plains, valley trains, deltas, and lake plains.

In a representative profile the surface layer is very dark brown sandy loam 9 inches thick. The subsoil is mottled, and is 24 inches thick. The upper part is yellowish-brown, very friable loamy sand, the next part is brown, friable sandy loam, and the lower part is yellowish-brown, very friable loamy sand. The underlying material is gravelly sand. It is grayish brown in the upper part, and is mottled brown in the lower part.

Wasepi soils have a low available water capacity. Permeability is moderately rapid.

Most of the acreage is used for crops. Some small areas are in woodland or are mined for sand and gravel.

Representative profile of Wasepi sandy loam, 0 to 4 percent slopes, 180 feet south and 100 feet east of the northwest corner of NE¼ sec. 3, T. 4 S., R. 7 E., in a cultivated area:

Ap—0 to 9 inches, very dark brown (10YR 2/2) sandy loam; weak, medium, granular structure; friable; 14 percent fine pebbles; slightly acid; abrupt, smooth boundary.

B1—9 to 14 inches, yellowish-brown (10YR 5/4) loamy sand; few, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; very friable; 10 percent fine pebbles; slightly acid; clear, smooth boundary.

B21t—14 to 21 inches, brown (10YR 4/3) sandy loam; few, fine, prominent, yellowish-brown (10YR 5/6) and few, fine, faint, grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; friable; common, thin clay films on faces of peds; 14 percent fine pebbles; slightly acid; clear, wavy boundary.

B22t—21 to 28 inches, brown (10YR 5/3) sandy loam; many, medium, faint, grayish-brown (10YR 5/2) and common, fine, distinct, yellowish-brown (10YR 5/6, 5/8) mottles; moderate, medium and fine, subangular blocky structure; friable; common, thin clay films on faces of peds; 10 percent fine pebbles; neutral; clear, wavy boundary.

B3—28 to 33 inches, yellowish-brown (10YR 5/4) loamy sand; few, fine, faint, yellowish-brown (10YR 5/6, 5/8) and common, fine, faint, grayish-brown (10YR 5/2) and brown (10YR 5/3) mottles; weak, medium, subangular blocky structure; very friable; 10 percent fine pebbles; neutral; clear, wavy boundary.

IIC1g—33 to 48 inches, grayish-brown (10YR 5/2) gravelly sand; single grained; loose; 45 percent fine pebbles; strong effervescence; mildly alkaline; clear, wavy boundary.

IIC2—48 to 60 inches, brown (10YR 5/3) gravelly sand; common, medium, faint, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/4) mottles; single grained; loose; 7 percent fine pebbles; strong effervescence; mildly alkaline.

The solum ranges from 20 to 40 inches in thickness, which coincides with the depth to effervescent material. The solum ranges from medium acid to neutral. Pebbles range from 2 to 25 percent throughout the solum and from 5 to 65 percent in the underlying material.

The Ap horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). In some places an A2 horizon is present. It is brown (10YR 5/3), pale-brown (10YR 6/3), or grayish-brown (10YR 5/2) loamy sand, sandy loam, gravelly loamy sand, or gravelly sandy loam. In uncultivated areas the A1 horizon is black (10YR 2/1) or very dark gray (10YR 3/1), and the A2 horizon is near maximum thickness.

The B1 horizon is yellowish brown (10YR 5/4,5/6) or light yellowish brown (10YR 6/4) and is mottled in many pedons. It is loamy sand, sandy loam, gravelly loamy sand, or gravelly sandy loam. It is absent in some pedons. The B2t horizon is brown (10YR 5/3, 4/3) or yellowish brown (10YR 5/4, 5/6) and is mottled. It is sandy loam or gravelly sandy clay loam. The B3 horizon has colors like those of the B2t horizon and is loamy sand, sandy loam, gravelly loamy sand, or gravelly sandy loam. It is absent in some pedons.

The IIC horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 4, and is mottled.

The Wasepi soils are generally near Gilford, Boyer, Ypsi, and Matherton soils in most landscapes. They are less gray in the upper part of the subsoil than the Gilford soils. They differ from the Boyer soils in having gray in the subsoil. They have more sand and less clay in the underlying material than the Ypsi soils. They have less clay in the subsoil than the Matherton soils.

WaA—Wasepi sandy loam, 0 to 4 percent slopes. This soil is in depressional areas, on broad low-lying areas, and along drainageways of outwash plains, valley trains, and lake plains. Areas are irregular in shape and range from 4 to more than 500 acres in size.

Included with this soil in mapping are small areas of Boyer loamy sand, Matherton sandy loam, Gilford sandy loam, and Ypsi sandy loam. Some areas of soils that are more than 40 inches deep over the underlying material

are also included. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols.

This soil has a seasonal high water table. If drained, it has a tendency to be droughty during the summer. Runoff is slow or very slow.

Most of the acreage is used for crops. Some small areas are in woodland or are mined for sand and gravel. Capability unit IIIw–4 (4b); woodland group 3s3; woody plant group 2; recreation group 16.

Wauseon Series

The Wauseon series consists of very poorly drained, nearly level soils formed in a thin layer of loamy textured glaciofluvial deposits and clayey textured glacial till or lacustrine deposits. These soils are on lake plains and ground moraines.

In a representative profile the surface layer is very dark brown fine sandy loam 10 inches thick. The subsoil is mottled and is 26 inches thick. The upper part is dark grayish-brown, friable fine sandy loam. Below this is gray, firm heavy sandy loam. Next is grayish-brown, friable sandy loam. The lower part is gray, firm silty clay. The underlying material is mottled brown heavy silty clay loam.

Wauseon soils have a moderate available water capacity. Permeability is moderately rapid in the loamy upper layers and very slow in the clayey lower layers.

Most of the acreage is used for crops. Some areas are in woodland.

Representative profile of Wauseon fine sandy loam, 1,245 feet west and 370 feet north of the southeast corner sec. 24, T. 4 S., R. 6 E., in a cultivated area:

Ap—0 to 10 inches, very dark brown (10YR 2/2) fine sandy loam; weak, medium, crumb structure; friable; neutral; abrupt, smooth boundary.

B1g—10 to 15 inches, dark grayish-brown (10YR 4/2) fine sandy loam; few, medium, prominent, yellowish-brown (10YR 5/6, 5/8) and brown (7.5YR 4/4) mottles; weak, medium, subangular blocky structure; friable; neutral; clear, smooth boundary.

B21g—15 to 25 inches, gray (10YR 4/1) heavy sandy loam; many, medium, prominent, yellowish-brown (10YR 5/6, 5/8) and brown (7.5YR 4/4) mottles; moderate, medium, subangular blocky structure; firm; mildly alkaline; clear, wavy boundary.

B22g—25 to 33 inches, grayish-brown (10YR 5/2) sandy loam; many coarse, prominent, yellowish-brown (10YR 5/6, 5/8) and brown (7.5YR 4/4) mottles; moderate, medium, subangular blocky structure; friable; mildly alkaline; abrupt, irregular boundary.

IIB23g—33 to 36 inches, gray (10YR 5/1) silty clay; many, coarse, prominent, strong-brown (7.5YR 5/6, 5/8) and brown (7.5YR 4/4) mottles; strong, medium, angular blocky structure; firm; mildly alkaline; clear, wavy boundary.

IIC—36 to 60 inches, brown (10YR 4/3) heavy silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/6, 5/8) mottles; massive; firm; slight effervescence; moderately alkaline.

The solum ranges from 24 to 36 inches in thickness, which coincides with depth to effervescent material. The solum ranges from slightly acid to mildly alkaline. Pebbles are less than 5 percent throughout the profile.

The Ap horizon has hue of 10YR or neutral, value of 1 to 3, and chroma of 0 to 2.

The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2, and is mottled. It is sandy loam or light sandy clay loam in the upper part and clay, silty clay, or silty clay loam in the lower part.

The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 3, and is mottled in many pedons. It is silty clay, clay, or silty clay loam.

The Wauseon soils are generally near Ypsi, Hoytville, Gilford, and Pewamo soils in most landscapes. They have more sand and less clay in the subsoil than the Hoytville and Pewamo soils. They are more gray in the subsoil than the Ypsi soils. They have less sand and more clay in the underlying material than the Gilford soils.

Ws—Wauseon fine sandy loam. This soil is in depressional areas, broad low-lying areas, and drainageways of lake plains and ground moraines. Slope is 0 to 2 percent. Areas are irregular in shape and range from 4 to more than 200 acres in size.

Included with this soil in mapping are small areas of Ypsi sandy loam, Lamson fine sandy loam, Gilford sandy loam, Hoytville silty clay loam, and Pewamo clay loam.

This soil has a high water table and is too wet for crop production unless drained. Runoff is slow or very slow. Depressional areas are subject to flooding by runoff from adjacent areas.

Most of the acreage is used for crops. Some areas are in woodland. Capability unit IIw–3 (3/1c); woodland group 2w1; woody plant group 5; recreation group 7.

Ypsi Series

The Ypsi series consists of somewhat poorly drained, nearly level, and gently sloping soils formed in a thin layer of loamy textured glaciofluvial deposits over clayey textured glacial till or lacustrine deposits. These soils are on deltas, lake plains, and ground moraines.

In a representative profile (fig. 14) the surface layer is very dark grayish-brown sandy loam 9 inches thick. The subsoil is 28 inches thick. The upper part is yellowish-brown, very friable loamy sand. The next part is mottled brown, friable sandy loam. The lower part is mottled pale-brown, very friable loamy sand. The underlying material is mottled gray silty clay.

Ypsi soils have a moderate available water capacity. Permeability is moderately rapid in the solum and slow in the underlying material.

Most of the acreage is used for crops. Some small areas are in woodland.

Representative profile of Ypsi sandy loam, 0 to 4 percent slopes, 578 feet east and 20 feet north of the center sec. 33, T. 4 S., R. 6 E., in a cultivated area:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; moderate, medium, granular structure; friable; many fine roots; slightly acid; abrupt, smooth boundary.

B1—9 to 14 inches, yellowish-brown (10YR 5/4) loamy sand; weak, fine, granular structure; very friable; few, fine, dark reddish-brown (5YR 2/2) concretions; common fine roots; slightly acid; gradual, wavy boundary.

B21t—14 to 21 inches, brown (10YR 5/3) light sandy loam; common, medium, distinct, yellowish-brown (10YR 5/6) and common, fine, faint grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; friable; few fine roots; few, thin, discontinuous, light brownish-gray (10YR 6/2) and brown (10YR 5/3) clay films on vertical and horizontal surfaces of peds; clay bridging between sand grains; slightly acid; gradual, wavy boundary.

B22t—21 to 29 inches, brown (10YR 5/3) sandy loam; common, medium, distinct, yellowish-brown (10YR 5/6) and common, fine, faint, grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky

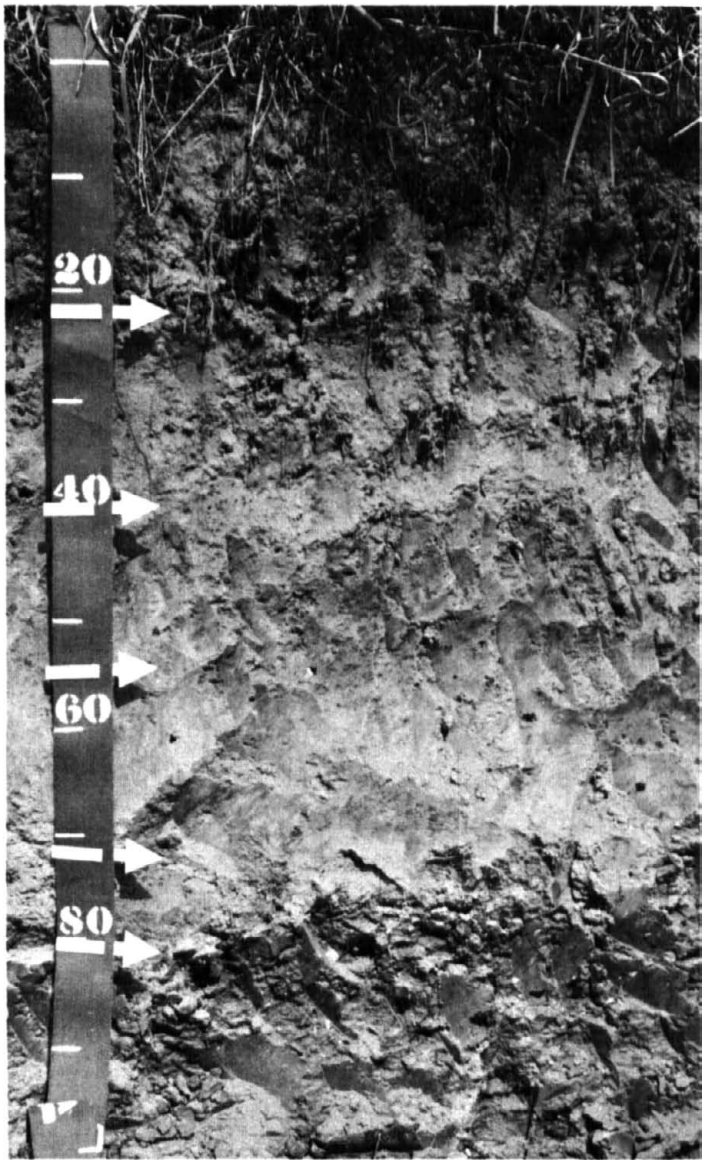

Figure 14.—**Profile of Ypsi sandy loam. Depth is marked in centimeters.**

structure; friable; few fine roots; few, thin, discontinuous, light brownish-gray (10YR 6/2) and brown (10YR 5/3) clay films on vertical and horizontal surfaces of peds; clay bridging between sand grains; slightly acid; gradual, wavy boundary.

B3—29 to 37 inches, pale-brown (10YR 6/3) loamy sand, light brownish-gray (10YR 6/2) coatings on peds; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; very friable; very few fine roots; less than 5 percent coarse fragments; neutral; abrupt, smooth boundary.

IIC1g—37 to 51 inches, gray (5Y 5/1) silty clay; common, medium, prominent, light olive-brown (2.5Y 5/4) mottles; weak, medium, angular blocky structure; firm; less than 5 percent coarse fragments; slight effervescence; mildly alkaline; gradual, wavy boundary.

IIC2g—51 to 60 inches, gray (5Y 5/1) silty clay; massive; firm; less than 5 percent coarse fragments; strong effervescence; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness, which coincides with depth to effervescent material. The solum is slightly acid or neutral. Pebble content is less than 5 percent in the lower part of the solum and ranges from 3 to 10 percent in the underlying material.

The Ap horizon has hue of 10YR and value and chroma of 2 or 3.

The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 6. It is mottled in the upper part in many pedons, and is mottled in the lower part. It is loamy sand or sandy loam. Iron-manganese concretions range from 2 to 10 millimeters in diameter. If concretions are absent chroma is 2 or less on the faces of peds.

The IIC horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 7, and chroma of 1 or 2, and is mottled. It is silty clay or clay.

The Ypsi soils are generally near Seward, Wauseon, Nappanee, and Wasepi soils in most landscapes. They differ from the Seward soils in having gray color in the subsoil. They are less gray in the subsoil than the Wauseon soils. They contain more sand and less clay in the subsoil than the Nappanee soils. They have less sand and more clay in the underlying material than the Wasepi soils.

YpA—Ypsi sandy loam, 0 to 4 percent slopes. This soil is in broad low-lying areas and along drainageways of lake plains and ground moraines. Areas are irregular in shape and range from 4 to more than 400 acres in size.

Included with this soil in mapping are small areas of Seward sandy loam, loamy subsoil variant, Wauseon fine sandy loam, Wasepi sandy loam, Nappanee silty clay loam, and Fox sandy loam. Some small areas of poorly drained and very poorly drained soils are identified on the soil map by spot symbols.

This soil has a seasonal high water table and is subject to ponding in nearly level areas. Runoff is slow or very slow.

Most of the acreage is used for crops. Some small areas are in woodland. Capability unit IIw–3 (3/1b); woodland group 2o4; woody plant group 2; recreation group 2.

Use and Management of the Soils

This section explains the nationwide capability classification system used by the Soil Conservation Service. It suggests use and management of the soils for crops and lists in table 2 predicted yields of the principal crops grown in Washtenaw County under improved management. This part of the survey also contains information on woodland, wildlife, engineering, county planning, and recreation.

Management for Crops [2]

Certain conditions are basic to good soil management. An adequate supply of plant nutrients and organic matter, a good depth of root zone, and the proper balance of air and water are necessary to grow crops efficiently. Drainage, control of erosion, rotation of crops, use of suitable crop varieties, and adequate use of lime and fertilizer are needed to improve yields. Lime and fertilizer should be applied according to the needs of the crops as determined by soil tests.

Many of the soils in Washtenaw County, such as

[2] RICHARD H. DRULLINGER, agronomist, Soil Conservation Service, helped prepare this section.

Brookston and Pewamo soils, need artificial drainage. Drainage improves the air-water relationship in the root zone. Spring planting, spraying, and harvesting are hampered and weed control is more difficult where drainage is poor. Tile drains or surface drainageways or both can be used, but they should be properly designed. Suitable outlets are difficult to find in some areas, particularly for Sloan and Edwards soils. Diversions may be used in some areas to carry surface runoff away from wet areas. Good soil structure and an ample supply of organic matter also benefit soil drainage. The low-lying areas have a short growing season because frost occurs late in spring and early in fall. Low areas where water stands for more than a few days or weeks can be especially valuable for wildlife and should not be drained.

The loss of surface soil through erosion reduces soil productivity and increases the sediment in streams and in other bodies of water. This is common on steeper areas of Miami and Morley soils. Erosion can generally be controlled by reducing the rate and volume of runoff and by increasing the rate of water absorption by the soil. Soil loss through surface runoff is reduced by growing meadow crops, cover crops, or green-manure crops and by the proper use of crop residue. Contour cultivation, stripcropping, minimum tillage, and the use of grassed waterways and diversions and terraces are other measures effective in controlling erosion. Windbreaks of trees or shrubs help to control soil blowing on Houghton and other muck soils and on Oakville, Tedrow, and other very sandy soils. Reducing the width of fields, alternating small grain with strips of row crops, keeping crop residue on the surface, and growing a permanent plant cover also help prevent soil blowing.

Cover and green-manure crops, proper use of crop residue, minimum tillage, and the application of livestock manure maintain and improve the organic-matter content and soil tilth. Fall plowing on nearly level, poorly drained or somewhat poorly drained soils at the proper moisture content may reduce damage to soil tilth and permit earlier tillage the following spring. No fall plowing should be done on sloping land or on soils subject to blowing. Grazing on the loamy and clayey soils when they are wet should be avoided because it results in compaction of the soil and poor tilth. Good management is most essential if cropping is intensive or if cultivation is continuous.

Additional help in managing the soils can be obtained by consulting the local representative of the Soil Conservation Service or the Cooperative Extension Service.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering purposes.

In the capability system, the kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These levels are defined in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.
Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat.
Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.
Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.
Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes. (None in Washtenaw County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c* shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a covenient grouping for making

many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol; for example, IIe–2 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class or degree of limitation; the small letter indicates the subclass or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The soil series represented in each capability unit are named, but this does not mean that all the soils of a given series are in the unit. To find the capability unit in which each soil has been grouped, refer to the "Guide to Mapping Units" at the end of this survey. For a complete explanation of the capability classification system, see Agriculture Handbook No. 210, Land Capability Classification (*6*).

CAPABILITY UNIT IIe–1

This unit consists of Morley loam, 2 to 6 percent slopes. This soil is moderately well drained or well drained. The subsoil and underlying material are moderately fine textured.

The available water capacity is high. Runoff is slow. Permeability is moderately slow or slow. This soil becomes hard and cloddy if tilled when wet. The moderately fine textured subsoil is difficult to work if it is exposed as a result of erosion. Some small wet spots delay planting and harvesting unless drained.

This soil is suited to all crops commonly grown in the county. Corn, wheat, soybeans, oats, and grass-legume hay are the main crops.

The chief management needs are controlling erosion and maintaining tilth and organic-matter content. Terracing and contour stripcropping help control erosion, but are difficult in some areas of short, complex slopes. In such areas cover crops, minimum tillage, and close-growing crops are needed. Manure and crop residue improve tilth and maintain organic-matter content.

CAPABILITY UNIT IIe–2

This unit consists of gently sloping Kendallville, Kidder, Miami, Riddles, Owosso, and Sisson soils and the Seward variant. These soils are moderately well drained or well drained. The subsoil is moderately coarse to moderately fine textured.

The available water capacity is moderate or high. Runoff is slow. Permeability ranges from moderately slow to moderately rapid except in the Seward variant where it is slow in the lower layers.

The soils of this unit are suitable for all crops commonly grown in the county. Corn, wheat, soybeans, and grass-legume hay are the main crops.

The chief management needs are controlling erosion and maintaining organic-matter content. Terracing and contour stripcropping help control erosion, but are difficult in some areas of short, complex slopes. In such areas, cover crops, minimum tillage, and close-growing crops are needed. Manure and crop residues maintain tilth and organic-matter content.

CAPABILITY UNIT IIe–3

This unit consists of Fox sandy loam, 2 to 6 percent slopes. This soil is well drained. The subsoil is moderately fine textured, and the underlying material is coarse textured.

The available water capacity is moderate. Runoff is slow. Permeability is moderate. This soil is slightly droughty.

This soil is suited to all crops commonly grown in the county. Corn, wheat, soybeans, oats, and grass-legume hay are the main crops.

The chief management needs are controlling erosion and maintaining organic-matter content and available water capacity. Terraces and diversions help control erosion. Cover crops, minimum tillage, and close-growing crops help control erosion where terraces and diversions are not practical. Manure and crop residue maintain organic-matter content and available water capacity. Irrigation improves yields.

CAPABILITY UNIT IIe–4

This unit consists of nearly level and gently sloping Blount, Conover, and Macomb soils. These soils are somewhat poorly drained. The subsoil is moderately fine textured.

The available water capacity is high. Runoff is slow. Permeability is moderate and moderately slow.

The soils of this unit are suited to all the crops commonly grown in the county if excess water is removed. Corn, wheat, soybeans, oats, and grass-legume hay are the main crops.

The chief management needs are controlling erosion and removing excess water. Cover crops, minimum tillage, and close-growing crops help control erosion. Planting on the contour, stripcropping, terracing, and diversions also help control erosion, but in many areas short, complex slopes make these practices impractical.

These soils are wet in spring and during periods of heavy rainfall. Wetness delays planting and harvesting. Artificial drainage is needed for intensive crop production in most areas. Manure and crop residue maintain the tilth and organic-matter content.

CAPABILITY UNIT IIw–1

The one soil in this unit, Palms muck, is nearly level and very poorly drained. It is 16 to 51 inches of muck, underlain by moderately coarse textured to moderately fine textured material.

The available water capacity is very high. Runoff is very slow. Flooding is a hazard. Permeability is rapid in the muck and moderate in the underlying material. This soil is too wet for crop production unless drained.

This soil is suited to corn, soybeans, and specialty crops if it is artificially drained. It is subject to soil blowing, subsidence, and burning when artificially drained. Stripcropping, windbreaks, irrigation, cover crops, narrow grain buffer strips, and controlled drainage help control soil blowing and subsidence. In many areas there are no suitable outlets for drainage systems, and catch basins and pumps are needed. Keeping subsurface drains at an even grade can be a problem because organic soils do not provide a suitable foundation for tile lines. The water table should be maintained at a depth that will allow good growth of plants and reduce soil subsidence.

CAPABILITY UNIT IIw–2

This unit consists of nearly level, somewhat poorly

drained to very poorly drained Blount, Hoytville, and Pewamo soils. The subsoil and underlying material are moderately fine textured or fine textured.

The available water capacity is moderate or high. Runoff is very slow. The poorly drained and very poorly drained soils in this unit are subject to flooding in depressional areas, and they are too wet for most crop production unless artificially drained. Permeability is slow or moderately slow.

The soils of this unit are suited to all crops commonly grown in the county. Corn, wheat, soybeans, oats, and grass-legume hay are the main crops in drained areas. Legume-hay winterkills in areas where flooding occurs.

The chief management needs are removing excess water and improving soil tilth. These soils are wet in spring and during periods of heavy rainfall. Surface and subsurface drainage is needed to remove excess water, but some areas are difficult to drain because the subsoil is slowly permeable. These soils become hard and cloddy if tilled when wet. Surface crusting after heavy rainfall makes it difficult for seedlings to emerge. Manure and crop residue improve tilth and organic-matter content and reduce surface crusting.

CAPABILITY UNIT IIw-3

This unit consists of nearly level and gently sloping, somewhat poorly drained Metamora and Ypsi soils and nearly level, very poorly drained Wauseon soils. The upper 20 to 40 inches is moderately coarse textured and the underlying material ranges from medium textured to fine textured.

The available water capacity is moderate or high. Runoff is slow or very slow. Permeability is moderately rapid in the upper part of these soils and ranges from moderately slow to very slow in the lower part. Wauseon soils are subject to flooding in depressional areas.

The soils of this unit are suited to all crops commonly grown in the county if excess water is removed. Corn, wheat, soybeans, and grass-legume hay are the main crops.

The chief management need is removing excess water. The hazard of erosion is slight on the gently sloping soils. In most areas artificial drainage is needed for intensive crop production. Cover crops, minimum tillage, and close-growing crops help control erosion. Manure and crop residue maintain the organic-matter content.

CAPABILITY UNIT IIw-4

This unit consists of nearly level, very poorly drained Brookston soils and nearly level, somewhat poorly drained Conover soils. The subsoil is moderately fine textured, and the underlying material is medium textured.

The available water capacity is high. Runoff is very slow. Permeability is moderate or moderately slow. Brookston soils are subject to flooding in depressional areas.

The soils of this unit are suited to most crops commonly grown in the county if excess water is removed. Corn, wheat, soybeans, oats, and grass-legume hay are the main crops. Legume-hay winterkills in areas where flooding occurs.

The chief management needs are removing excess water and maintaining soil tilth and organic-matter content. In most areas artificial drainage is needed for intensive crop production. Surface drainage is somewhat difficult in the Conover-Brookston complex because slopes are uneven and small areas are depressional. Manure and crop residue maintain good tilth and organic-matter content.

CAPABILITY UNIT IIw-5

This unit consists of nearly level and gently sloping, somewhat poorly drained to very poorly drained Colwood, Dixboro, Kibbie, Lamson, Matherton, Pella, and Sebewa soils. The subsoil is moderately coarse textured to moderately fine textured, and the underlying material is coarse textured to moderately fine textured.

The available water capacity is moderate or high. Runoff is slow or very slow. Depressional areas of many of these soils are subject to flooding. Permeability is moderate, except for the Matherton and Sebewa soils, where permeability is rapid in the underlying material.

The soils of this unit are suited to most crops commonly grown in the county if excess water is removed. Corn, wheat, soybeans, oats, and grass-legume hay are the main crops. Legume-hay winterkills in areas where flooding occurs.

The chief management need is removing excess water. The hazard of erosion on the gently sloping soils is slight. In most areas artificial drainage is needed for intensive crop production. Special precautions must be taken when installing subsurface drains to prevent sand and silt from plugging the drains. Drains are difficult to install because these soils cave when wet. Cover crops, minimum tillage, and close-growing crops help control erosion. Manure and crop residue maintain organic-matter content and good tilth.

CAPABILITY UNIT IIs-1

This unit consists of Fox sandy loam, 0 to 2 percent slopes. This soil is well drained. The subsoil is moderately fine textured, and the underlying material is coarse textured.

The available water capacity is moderate. Runoff is slow. Permeability is moderate. This soil is slightly droughty.

This soil is suited to all crops commonly grown in the county. Corn, wheat, soybeans, oats, and grass-legume hay are the main crops.

The chief management needs are maintaining organic-matter content and available water capacity. Manure and crop residue maintain organic-matter content and available water capacity. Irrigation improves yields.

CAPABILITY UNIT IIIe-1

This unit consists of St. Clair clay loam, 2 to 6 percent slopes. This soil is moderately well drained. The subsoil and underlying material are fine textured.

The available water capacity is moderate. Runoff is medium. Permeability is slow or very slow. If tilled when wet, this soil becomes very hard and cloddy. The fine-textured subsoil is very difficult to till and makes a poor seedbed if it is exposed as a result of erosion. Some small, wet spots delay planting and harvesting unless drained.

This soil is suited to all crops commonly grown in the

county. Corn, wheat, oats, and grass-legume hay are the main crops.

The chief management needs are controlling erosion, improving tilth, and maintaining organic-matter content. Terracing and contour stripcropping help control erosion, but are difficult in many areas of short, complex slopes. In such areas cover crops, minimum tillage, and close-growing crops are needed. Manure and crop residues improve tilth and maintain organic-matter content.

CAPABILITY UNIT IIIe–2

The one soil in this unit, St. Clair clay loam, 6 to 12 percent slopes, is moderately well drained. Both the subsoil and underlying material are fine textured.

The available water capacity is moderate. Runoff is rapid. Permeability is slow or very slow. Crops lack moisture during dry periods because some of the rainfall is lost as runoff. If tilled when wet, this soil becomes very hard and cloddy. The fine-textured subsoil is very difficult to till and makes a poor seedbed if it is exposed as a result of erosion. Some small, wet spots delay planting and harvesting unless drained.

This soil is suited to all crops commonly grown in the county. Corn, wheat, soybeans, oats, and grass-legume hay are the main crops.

The chief management needs are controlling erosion, improving tilth, and maintaining organic-matter content. Terracing and contour stripcropping help control erosion, but are difficult in areas of short, complex slopes. In such areas cover crops, minimum tillage, and a rotation of more close-growing crops are needed. Manure and crop residue improve tilth and maintain organic-matter content.

CAPABILITY UNIT IIIe–3

This unit consists of sloping, well drained or moderately well drained Boyer, Oshtemo, Seward, and Spinks soils and the Fox variant. The subsoil ranges from coarse textured to moderately fine textured.

The available water capacity is low. Runoff is slow or medium. Permeability ranges from moderate to rapid except in the Seward soils where it is slow in the underlying material. The soils of this unit are droughty. Cobbles in the Fox variant hinder tillage.

The soils of this unit are suited to all crops commonly grown in the county, mainly corn, oats, wheat, and grass-legume hay.

The chief management needs are controlling erosion and soil blowing, maintaining organic-matter content, and improving available water capacity. Manure, crop residue, and cover crops help control erosion and soil blowing, maintain organic-matter content, and improve available water capacity. Irrigation improves crop yields.

CAPABILITY UNIT IIIe–4

This unit consists of Morley loam, 6 to 12 percent slopes. This soil is moderately well drained or well drained. The subsoil and underlying material are moderately fine textured.

The available water capacity is high. Runoff is medium. Permeability is moderately slow or slow. If tilled when wet, this soil becomes hard and cloddy. The moderately fine textured subsoil is difficult to work if it is exposed as a result of erosion. The surface crusts after a heavy rain. Some small, wet spots delay planting and harvesting unless drained.

This soil is suited to all crops commonly grown in the county, mainly corn, wheat, soybeans, oats, and grass-legume hay. Crops may lack moisture during dry periods because water is lost as runoff.

The chief management needs are controlling erosion, improving tilth, and maintaining organic-matter content. Terracing and contour stripcropping help control erosion, but are difficult in areas of short, complex slopes. In such areas cover crops, minimum tillage, and more close-growing crops in a rotation are needed. Manure and crop residue improve tilth and maintain organic-matter content.

CAPABILITY UNIT IIIe–5

This unit consists of sloping, well-drained Kendallville, Kidder, Miami, Owosso, Riddles, and Sisson soils. The subsoil is moderately fine textured, except in Owosso and Riddles soils, where it is moderately coarse textured.

The available water capacity is moderate or high. Runoff is medium. Permeability ranges from moderately rapid to moderately slow.

The soils of this unit are suited to all crops commonly grown in the county. Corn, wheat, oats, soybeans, and grass-legume hay are the main crops.

The chief management needs are controlling erosion, maintaining organic-matter content, and improving available water capacity. Terracing, contour stripcropping, diversions, and grassed waterways help control erosion. Terraces, contour strips, and diversions are difficult to install in areas of short, complex slopes. In such areas cover crops, minimum tillage, and more close-growing crops in a rotation are needed. Manure and crop residue improve tilth and available water capacity and maintain organic-matter content.

CAPABILITY UNIT IIIe–6

The one soil in this unit, Fox sandy loam, 6 to 12 percent slopes, is well drained. The subsoil is moderately fine textured, and the underlying material is coarse textured.

The available water capacity is moderate. Runoff is medium. Permeability is moderate.

This soil is suited to all crops commonly grown in the county, mainly corn, wheat, oats, and grass-legume hay. This soil is slightly droughty.

The chief management needs are controlling erosion, maintaining organic-matter content, and improving available water capacity. Terracing, contour stripcropping, diversions, and grassed waterways help control erosion. Terraces, contour strips, and diversions are difficult to install in areas of short, complex slopes. In such areas cover crops, minimum tillage, and more close-growing crops in a rotation are needed. Manure and crop residue improve available water capacity and maintain organic-matter content. Irrigation improves crop yields.

CAPABILITY UNIT IIIe–7

The one soil in this unit, Nappanee silty clay loam, 2 to 6 percent slopes, is somewhat poorly drained. The subsoil is fine textured.

The available water capacity is moderate. Runoff is slow. Permeability is very slow. If tilled when wet, this soil becomes very hard and cloddy.

This soil is suited to all the crops commonly grown in the county. Corn, wheat, soybeans, oats, and grass-legume hay are the main crops.

The chief management needs are controlling erosion, removing excess water, improving tilth, reducing surface crusting, and maintaining organic-matter content. Cover crops and minimum tillage help control erosion. Manure and crop residue improve tilth, maintain the organic-matter content, and reduce surface crusting. Artificial drainage removes excess water, but the very slow permeability of the subsoil retards water movement.

CAPABILITY UNIT IIIw–1

This unit consists of nearly level, poorly drained or very poorly drained Gilford and Granby soils. The subsoil is moderately coarse textured or coarse textured.

The available water capacity is low. Runoff is very slow. Depressional areas are subject to flooding. Permeability is moderately rapid. These soils are too wet for most crop production unless they are artificially drained. If drained, they are droughty.

The soils of this unit are suited to most crops commonly grown in the county, mainly corn, wheat, oats, and soybeans. Grass-legume hay is grown in some places, but winterkills where flooding occurs.

The chief management needs are improving drainage and controlling soil blowing. Subsurface drains and open ditches improve drainage. Ditchbanks tend to cave, however, and sand can enter and plug subsurface drains. In some areas there are no suitable outlets for drainage systems. Cover crops, crop residue, stripcropping, and windbreaks help control soil blowing.

CAPABILITY UNIT IIIw–2

This unit consists of Nappanee silty clay loam, 0 to 2 percent slopes. This soil is somewhat poorly drained. The subsoil is fine textured.

The available water capacity is moderate. Runoff is very slow. Permeability is very slow. If tilled when wet, this soil becomes hard and cloddy.

This soil is suited to all crops commonly grown in the county if it is artificially drained. Corn, wheat, soybeans, and oats are the main crops. Grass-legume hay is grown in some places, but winterkills in some years.

The chief management needs are removing excess water, maintaining organic-matter content, and improving tilth. Subsurface drains, surface drains, and open ditches improve drainage. Cover crops, crop residue, and manure maintain organic-matter content and improve tilth. Minimum tillage also improves tilth.

CAPABILITY UNIT IIIw–3

The one soil in this unit, Houghton muck, is very poorly drained. It is more than 51 inches deep.

The available water capacity is very high. Runoff is very slow, and areas of this soil are subject to flooding. Permeability is rapid. This soil is too wet for crop production unless it is artificially drained. If drained, it is subject to soil blowing, subsidence, and burning.

This soil is suited to corn and specialty crops if it is drained. The chief management need is removing excess water. Subsurface drains and open ditches are needed. Keeping subsurface drains at an even grade can be a problem because organic soils do not provide a suitable foundation for the tile lines. In some areas there are no suitable drainage outlets. Sprinkler irrigation protects crops against frost and fire. Cover crops, windbreaks, and sprinkler irrigation help control soil blowing. Maintaining the water table at a depth just below the root zone reduces subsidence.

CAPABILITY UNIT IIIw–4

This unit consists of nearly level and gently sloping, somewhat poorly drained Tedrow, Thetford, and Wasepi soils. The subsoil is coarse textured or moderately coarse textured.

The available water capacity is low. Runoff is very slow or slow. Permeability is rapid or moderately rapid. When artificially drained, these soils are droughty.

The soils of this unit are suited to all crops commonly grown in the county if they are artificially drained. Corn, wheat, oats, soybeans, and grass-legume hay are the main crops.

The chief management needs are removing excess water, maintaining organic-matter content, and controlling soil blowing. Subsurface drains and open ditches are needed. Cover crops, crop residue, manure, and minimum tillage maintain organic-matter content, control soil blowing, and improve the available water capacity.

CAPABILITY UNIT IIIs–1

This unit consists of nearly level and gently sloping, well-drained Boyer, Oshtemo, and Spinks soils and the Fox variant and nearly level and gently sloping, moderately well drained Seward soils. The subsoil is coarse textured or moderately coarse textured, except for Fox variant, which has a moderately fine textured subsoil.

These soils are droughty. The available water capacity is low. Runoff is slow or very slow. Permeability is moderately rapid in Boyer, Oshtemo, and Spinks soils; rapid in the upper part of the Seward soil and slow in the lower part; and moderate in the subsoil of the Fox variant and rapid in the underlying material. Cobblestones make tillage difficult on the Fox variant.

The soils of this unit are suited to all crops commonly grown in the county, mainly corn, wheat, oats, and grass-legume hay. Some areas are irrigated and used for specialty crops.

The chief management needs are maintaining organic-matter content, improving available water capacity, and controlling soil blowing and erosion. Manure, crop residue, and cover crops help maintain organic-matter content, improve available water capacity, and control erosion. Stripcropping and windbreaks help control soil blowing. Irrigation improves crop yields.

CAPABILITY UNIT IVe–1

This unit consists of moderately steep, moderately well drained and well drained Morley and St. Clair soils. The subsoil is moderately fine textured or fine textured.

The available water capacity is moderate or high. Runoff is rapid or very rapid. Permeability ranges from moderately slow to very slow. Crops lack moisture during dry periods because much of the rainfall is lost as

runoff. If tilled when wet, this soil becomes very hard and cloddy. The subsoil is very difficult to till and makes a poor seedbed if it is exposed through erosion.

The soils of this unit are suited to all crops commonly grown in the county, chiefly corn, wheat, oats, and grass-legume hay. Because of the erosion hazard, the rotation should consist mostly of close-growing crops, such as small grain and hay, instead of row crops.

The chief management needs are controlling erosion, improving tilth, and maintaining organic-matter content. Diversions and contour strips help control erosion but are difficult to install in many areas of short, complex slopes. In such areas, minimum tillage and a rotation of only close-growing crops are needed. Manure and crop residue improve tilth and infiltration rates and maintain organic-matter content.

CAPABILITY UNIT IVe-2

This unit consists of moderately steep, well-drained Fox, Kidder, and Miami soils. The subsoil is moderately fine textured.

The available water capacity is moderate or high. Runoff is medium or rapid. Permeability is moderate or moderately slow. Crops lack moisture during dry periods because some of the rainfall is lost as runoff. The moderately fine textured subsoil is difficult to till and makes a poor seedbed if it is exposed through erosion.

The soils of this unit are suited to all crops commonly grown in the county, chiefly corn, wheat, oats, and grass-legume hay. Because of the erosion hazard, the rotation should consist mostly of close-growing crops, such as small grain and hay, instead of row crops.

The chief management needs are controlling erosion, maintaining organic-matter content, and improving available water capacity. Diversions and contour strips help control erosion but are difficult to install in many areas of short, complex slopes. In such areas, minimum tillage and a rotation of only close-growing crops are needed. Manure and crop residue maintain organic-matter content and tilth and improve available water capacity.

CAPABILITY UNIT IVe-3

This unit consists of moderately steep, well-drained Boyer and Spinks soils and the Fox variant. The subsoil ranges from coarse textured to moderately fine textured.

The available water capacity is low. Runoff is medium or rapid. Permeability is moderate to rapid. These soils are droughty. Cobblestones make tillage difficult on the Fox variant.

The soils of this unit are suited to most crops commonly grown in the county, chiefly wheat, oats, and grass-legume hay. Because of the erosion hazard, the rotation should consist mostly of close-growing crops, such as small grain and hay, instead of row crops.

The chief management needs are controlling erosion and soil blowing, maintaining organic-matter content, and improving available water capacity. Diversions and contour strips help control erosion, but are difficult to install in many areas of short, complex slopes. In such areas, windbreaks, close-growing crops, and minimum tillage are needed for control of soil blowing and erosion. Manure and crop residue increase the organic-matter content and improve the available water capacity.

CAPABILITY UNIT IVw-1

The one soil in this unit, Adrian muck, is nearly level and very poorly drained. It is underlain by coarse textured material at a depth of 16 to 51 inches.

The available water capacity is high. Runoff is very slow. Permeability is rapid. This soil is subject to flooding. Unless drained, it is too wet for crop production.

This soil is suited to corn, soybeans, and specialty crops. Where artificially drained, it is subject to soil blowing, subsidence, and burning. Windbreaks, stripcropping, cover crops, and narrow grain buffer strips help control soil blowing. Subsidence and burning can be reduced by maintaining the water level at a depth just below the root zone.

In many areas, there are no suitable outlets for drainage systems. Ditchbanks are unsuitable and cave, and subsurface drains are easily plugged by the sandy underlying material. Keeping subsurface drains at an even grade can be a problem because organic soils do not provide a suitable foundation for tile lines.

This soil is also subject to frost during the growing season. Sprinkler irrigation protects crops from frost and also helps control soil blowing. As the muck becomes thinner from subsidence and soil blowing, it becomes droughty.

CAPABILITY UNIT IVw-2

This unit consists of nearly level, very poorly drained Edwards soils and the Edwards variant. These are muck soils underlain by marl at a depth of less than 51 inches.

The available water capacity is very high in the Edwards muck and variable in the Edwards variant. Runoff is very slow. These soils are subject to flooding (fig. 15). Permeability is rapid in the muck and variable in the marl. Unless drained, these soils are too wet for crop production.

These soils are suited to corn, grass-legume hay, and specialty crops. They are subject to frost during the growing season. If artificially drained, they are subject to soil blowing and burning. Windbreaks, stripcropping, cover crops, and narrow grain buffer strips help control soil blowing.

Sprinkler irrigation protects crops from frost and the soil from blowing and burning. In many areas, there are no suitable outlets for drainage systems. Keeping surface drains at an even grade can be a problem because organic soils do not provide a suitable foundation for tile lines.

CAPABILITY UNIT IVs-1

This unit consists of nearly level to sloping, well drained and moderately well drained Oakville soils. The subsoil is coarse textured.

The available water capacity is low. Runoff is very slow or slow. Permeability is very rapid. This soil is droughty. It is subject to soil blowing and in sloping areas is subject to erosion.

These soils are suited to crops, but soil moisture is rarely adequate for good crop growth. Wheat, oats, and grass-legume hay are the crops most commonly grown.

The chief management needs are controlling soil

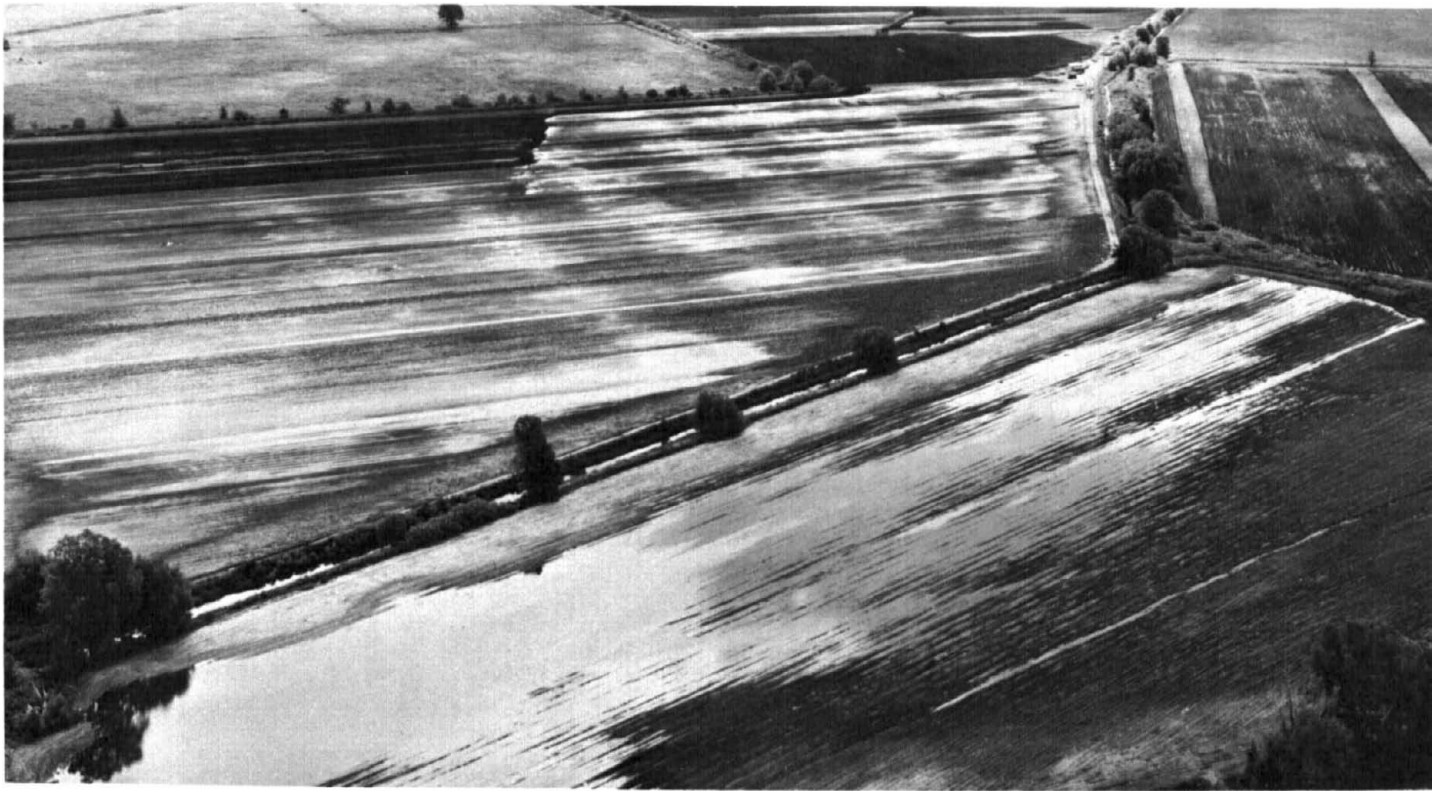

Figure 15.—**Ponded area of Edwards muck, shallow variant.**

blowing and maintaining soil moisture. Windbreaks, cover crops, and crop residue on the surface help control soil blowing. Manure and crop residue also increase the organic-matter content and the available water capacity. Crop residue and manure kept near the surface by minimum tillage or mulching reduces evaporation and helps control soil blowing and erosion. Irrigation generally increases crop yields.

CAPABILITY UNIT Vw–1

This unit consists of nearly level and poorly drained or very poorly drained Cohoctah and Sloan soils. The subsoil is moderately coarse textured or moderately fine textured.

The available water capacity is moderate or high. Runoff is slow or very slow. These soils are subject to flooding. Permeability is moderate or moderately rapid. Cohoctah soils are slightly droughty.

These soils are suited to crops and pasture, but frequent flooding, wetness, lack of drainage outlets, and meandering streams that cut these soils into small tracts make farming unfeasible in most areas. Pasture is the most common use.

CAPABILITY UNIT VIe–1

This unit consists of steep, well drained and moderately well drained Miami, Morley, and St. Clair soils. The subsoil is moderately fine textured or fine textured.

The available water capacity is moderate or high. Runoff is rapid or very rapid. Permeability ranges from moderate to very slow. These soils are subject to erosion. They are too steep for most crop production.

Some areas of these soils are used for pasture. The chief management need is maintaining a protective plant cover to prevent erosion. Slopes limit the use of farm machinery. Where farm machinery can be used, pasture yields can be increased by seeding legumes and adding fertilizer. These soils have poor tilth if tilled when wet, and they crush when dry. Consequently, establishing legumes is difficult. Limiting grazing helps prevent damage to the sod and formation of gullies.

CAPABILITY UNIT VIe–2

This unit consists of steep and very steep, well-drained Boyer, Fox, Kidder, and Spinks soils. The subsoil ranges from coarse textured to moderately fine textured.

The available water capacity is low or moderate. Runoff is rapid or very rapid. Permeability is moderate or moderately rapid. These soils are too steep for crop production. They are subject to erosion, and all but Fox and Kidder soils are droughty.

Some areas are used for pasture. The chief management need is maintaining a protective plant cover to prevent erosion. Slopes limit the use of farm machinery. Where farm machinery can be used, pasture yields can be increased by seeding legumes and adding fertilizer. Limited grazing prevents damage to the sod and formation of gullies.

CAPABILITY UNIT VIIe–1

This unit consists of very steep, well-drained Boyer and Miami soils. The subsoil is moderately fine textured and moderately coarse textured.

These soils are subject to erosion and are too steep for crop production. Runoff is rapid or very rapid. The available water capacity is low in Boyer soils and high in Miami soils. Permeability is moderately rapid in Boyer soils and moderate and moderately slow in Miami soils.

Some areas of these soils are used for permanent pasture. In such areas grazing must be limited to prevent damage to the sod and formation of gullies.

Predicted yields

The soils of Washtenaw County vary considerably in productivity. Some consistently produce high yields of cultivated crops. Others are better suited to less intensive uses because of soil limitations or an erosion hazard.

Yields per acre of the principal crops are listed for most soils of the county in table 2. The yields are the averages for crops grown under high level management.

Under high-level management—

1. The cropping system is adapted to the soil in the proper proportion of row crops to legume-grass crops.
2. Management for control of water erosion and soil blowing includes contour tillage, stripcropping, minimum tillage, and return of crop residue.
3. The quantity of lime applied is determined by soil tests.
4. The kind and amount of fertilizer applied, also determined by soil tests, is based on the amounts and kinds of plant nutrients needed by the crop.
5. Where needed, an adequate system of artificial drainage is installed.
6. Improved varieties of plants and high quality seeds are selected.
7. Weeds, diseases, and insects are controlled.
8. Methods of tillage and harvest are suitable and timely.
9. Cover crops, crop residue, and manure are returned to the soil to improve soil structure, supply organic matter, and control erosion.

The yields listed can be expected over a period of several years. They are not presumed to be the maximum obtainable. Maximum yields can be considerably higher during seasons of favorable soil, plant, and weather conditions. Irrigation has not been considered a part of improved management. It is limited mainly to the production of potatoes and truck and fruit crops.

The yields in table 2 predict the relative productivity of the soils in Washtenaw County. Although the figures become outdated, they will continue to indicate the relative productivity of the soils.

Woodland [3]

At the time of settlement, Washtenaw County was almost entirely covered with forest. Only a few areas of marshland were not forested. Hardwoods, such as oak, hickory, sugar maple, and basswood, were dominant on the well-drained soils. Red maple, silver maple, and ash were dominant on the wet mineral soils. Tamarack was the principal tree on the muck soils.

At present, about 83,500 acres, or nearly 18 percent of the county, is woodland. Nearly 80 percent of this woodland consists of farm and small private woodlots. The rest is State-owned or is in suburban residential holdings.

Woodland groups

The soils of Washtenaw County have been assigned to woodland groups to assist owners in planning the use of their soils for wood crops. Each group is made up of soils that are suited to the same kinds of trees, that need approximately the same kind of management when the vegetation on them is similar, and that have about the same potential productivity.

Each woodland group is identified by a three-part symbol, for example, 1r1, 2o4, or 5w1. The first part of the symbol, always an Arabic numeral, is the woodland suitability class, which indicates relative potential productivity of the soils in the group. The numeral 1 means high, 2 medium high, 3 medium, 4 medium low, and 5 low. These five classes indicate the following approximately expected yields per acre in cords and board feet for an indicator forest type or key species:

Woodland class and productivity		Northern red oak, sugar maple, red maple		Aspen	
		Board feet	*Cords*	*Board feet*	*Cords*
1	High	>260	>1.0	>200	>1.2
2	Medium high	190–260	0.8–1.0	150–200	0.8–1.2
3	Medium	130–190	0.6–0.8	125–150	0.5–0.8
4	Medium low	90–130	0.4–0.6	100–125	0.2–0.5
5	Low	<90	<0.4	<100	<0.2

One cubic foot equals about 5 board feet, and about 2.5 cords equal 1,000 board feet (International ¼-inch rule). A cord is dimensionally 128 cubic feet, but contains only about 80 cubic feet of finished wood. Production of 0.2 cords or less is "noncommercial" by definition.

The expected yields apply to managed stands in which intermediate cuttings of culled trees have left ample room for the more desirable trees to develop.

The potential productivity is determined through field evaluations and measurements of site index. Site index is the average height at 50 years of age of the dominant and codominant trees of a given species on a specified kind of soil in natural, unmanaged stands. For the merchantable hardwoods and softwoods in this county, the site index is based on the height reached in 50 years. Research studies of site index have been used to estimate approximate expected growth and yield per acre in cords and board feet.

The second part of the woodland group symbol is a letter, which indicates an important soil property. The letter *c* indicates that the main limitation is the kind or amount of clay in the upper part of the soil; *d* that the soil is shallow or contains layers that restrict roots; *f*, that the soil contains large amounts of coarse fragments; *o*, that the soil has few limitations that restrict its use for trees; *r*, that the main limitation is steep

[3] By JACQUES J. PINKARD, woodland conservationist, Soil Conservation Service.

TABLE 2.—*Predicted average yields per acre under high level of management*

[Dashes indicate that the crop is not suited to the soil or is not ordinarily grown on it. Only arable soils are listed]

Soil	Corn for—		Oats	Wheat	Soybeans	Grass-legume hay
	Grain	Silage				
	Bu	*Tons*	*Bu*	*Bu*	*Bu*	*Tons*
Adrian muck	80	15			30	[1] 2.4
Blount loam, 0 to 2 percent slopes	105	18	70	48	40	5.2
Blount loam, 2 to 6 percent slopes	100	17	70	55	35	5.2
Boyer loamy sand, 0 to 6 percent slopes	65	12	45	35	28	3.2
Boyer loamy sand, 6 to 12 percent slopes	60	10	40	28	20	2.8
Boyer loamy sand, 12 to 18 percent slopes	40	8	30	20	14	2.0
Boyer loamy sand, 18 to 25 percent slopes						**2.0**
Boyer-Kidder complex, 15 to 35 percent slopes						2.0
Brookston loam	125	19	90	60	45	6.0
Cohoctah fine sandy loam, frequently flooded						[1] 2.5
Conover loam, 0 to 4 percent slopes	120	18	90	55	45	5.0
Conover-Brookston loams, 0 to 2 percent slopes	120	18	95	60	40	5.2
Dixboro-Kibbie fine sandy loams, 0 to 4 percent slopes	105	17	70	50	35	4.5
Edwards muck	90	16			35	[1] 3.0
Edwards muck, shallow variant	80	15			30	[1] 2.5
Fox sandy loam, 0 to 2 percent slopes	90	16	75	45	35	3.5
Fox sandy loam, 2 to 6 percent slopes	85	14	70	40	35	3.5
Fox sandy loam, 6 to 12 percent slopes	75	13	65	35	30	3.0
Fox sandy loam, 12 to 18 percent slopes	65	12	60	32	20	2.5
Fox sandy loam, 18 to 25 percent slopes						2.2
Fox cobbly sandy loam, cobbly variant, 2 to 6 percent slopes	65	12	40	35	25	3.2
Fox cobbly sandy loam, cobbly variant, 6 to 12 percent slopes	60	10	35	30	20	2.8
Fox cobbly sandy loam, cobbly variant, 12 to 18 percent slopes	40	8	25	20	15	2.0
Gilford sandy loam	88	15	70	45	32	4.0
Granby fine sand	75	14	55	35	30	3.3
Houghton muck	100	17			34	[1] 3.0
Hoytville silty clay loam	110	18	70	50	40	4.5
Kendallville loam, 2 to 6 percent slopes	100	17	70	50	35	3.5
Kendallville loam, 6 to 12 percent slopes	90	16	65	45	30	3.3
Kibbie fine sandy loam, 0 to 4 percent slopes	110	18	80	50	38	4.8
Kidder sandy loam, 2 to 6 percent slopes	100	16	70	50	35	4.0
Kidder sandy loam, 6 to 12 percent slopes	85	15	65	45	30	3.5
Kidder sandy loam, 12 to 18 percent slopes	75	13	60	35	20	3.0
Lamson-Colwood complex	110	18	70	50	37	4.5
Macomb loam, 0 to 4 percent slopes	110	18	75	50	35	4.0
Matherton sandy loam, 0 to 4 percent slopes	100	17	70	45	33	4.0
Metamora sandy loam, 0 to 4 percent slopes	95	16	75	50	35	4.0
Miami loam, 2 to 6 percent slopes	110	18	80	50	38	4.5
Miami loam, 6 to 12 percent slopes	95	16	70	47	33	4.0
Miami loam, 12 to 18 percent slopes	85	15	60	36	23	3.5
Miami loam, 18 to 25 percent slopes						3.0
Morley loam, 2 to 6 percent slopes	95	16	70	45	30	4.5
Morley loam, 6 to 12 percent slopes	85	15	65	40	27	4.0
Morley loam, 12 to 18 percent slopes	70	13	55	32	20	3.5
Morley loam, 18 to 25 percent slopes						3.0
Nappanee silty clay loam, 0 to 2 percent slopes	90	16	75	37	32	4.5
Nappanee silty clay loam, 2 to 6 percent slopes	80	15	70	37	28	4.5
Oakville fine sand, 0 to 6 percent slopes	50	10	44	26	18	2.5
Oshtemo loamy sand, 0 to 6 percent slopes	70	13	50	30	28	3.2
Oshtemo loamy sand, 6 to 12 percent slopes	65	12	45	28	20	2.8
Owosso-Miami complex, 2 to 6 percent slopes	100	17	75	52	30	4.5
Owosso-Miami complex, 6 to 12 percent slopes	90	16	70	46	26	4.2
Palms muck	110	18			40	[1] 3.0
Pella silt loam	125	19	90	55	45	5.7
Pewamo clay loam	110	18	80	50	40	4.5
Riddles sandy loam, 2 to 6 percent slopes	105	17	70	50	35	4.0
Riddles sandy loam, 6 to 12 percent slopes	95	16	65	45	30	3.5
Sebewa loam	110	18	80	50	36	4.5
Seward loamy fine sand, 2 to 6 percent slopes	65	12	60	30	25	3.5
Seward loamy fine sand, 6 to 12 percent slopes	55	11	55	28	20	3.0
Seward sandy loam, loamy subsoil variant, 2 to 6 percent slopes	90	16	70	45	30	4.0
Sisson fine sandy loam, 2 to 6 percent slopes	100	17	80	50	35	4.0
Sisson fine sandy loam, 6 to 12 percent slopes	90	16	70	45	30	3.5
Sloan silt loam, wet						[1] 2.5
Spinks loamy sand, 0 to 6 percent slopes	60	12	40	30	24	3.2
Spinks loamy sand, 6 to 12 percent slopes	52	10	35	27	20	3.0
Spinks loamy sand, 12 to 18 percent slopes	40	8	30	20	15	2.0

TABLE 2.—*Predicted average yields per acre under high level of management*—Continued

Soil	Corn for—		Oats	Wheat	Soybeans	Grass-legume hay
	Grain	Silage				
	Bu	*Tons*	*Bu*	*Bu*	*Bu*	*Tons*
Spinks loamy sand, 18 to 25 percent slopes						1.5
Spinks-Oshtemo loamy sands, 0 to 6 percent slopes	65	12	55	32	25	3.2
St. Clair clay loam, 2 to 6 percent slopes	90	16	55	40	35	4.5
St. Clair clay loam, 6 to 12 percent slopes	80	15	45	35	30	4.0
St. Clair clay loam, 12 to 18 percent slopes	65	12	40	25	25	3.0
St. Clair clay loam, 18 to 35 percent slopes						2.8
Tedrow loamy fine sand, 0 to 4 percent slopes	75	12	55	30	28	3.5
Thetford loamy sand, 0 to 4 percent slopes	80	15	60	35	30	3.5
Wasepi sandy loam, 0 to 4 percent slopes	85	14	65	40	35	4.2
Wauseon fine sandy loam	110	18	80	50	36	4.5
Ypsi sandy loam, 0 to 4 percent slopes	95	16	75	45	35	4.2

[1] Rating is for reed canarygrass.

slope; *s*, that the soil is sandy and dry, differs little in texture between the surface layer and subsoil, and has low available water capacity and generally a low supply of plant nutrients; and *w*, that water in or on the soil, either seasonally or year round, is the chief limitation.

The third part of the symbol, another Arabic numeral, indicates the degree of hazard or limitation and general suitability of the soil for specified kinds of trees. The hazards and limitations that affect management are erosion hazard, equipment limitations, seedling mortality, windthrow hazard, and plant competition. They are expressed as *slight*, *moderate*, or *severe*.

Erosion hazard is rated according to the risk of erosion on well-managed woodland. It is *slight* if there is

Figure 16.—Windbreak on Fox sandy loam.

little or no risk of erosion, *moderate* if attention is needed during or after logging or logging construction, and *severe* if intensive management is needed to avoid excessive soil loss.

Equipment limitations differ according to slope, soil wetness, and other factors that restrict or prohibit the use of equipment commonly used in tending and harvesting trees. The limitation is *slight* if there is no restriction in the kind of equipment or in the time of year it is used. The limitation is *moderate* if the use of equipment is restricted for less than 3 months of the year. The limitation is *severe* if special equipment is needed and its use is restricted for more than 3 months of the year.

Seedling mortality refers to the expected degree of mortality of planted seedlings as influenced by the kinds of soil or topography when plant competition is not a limiting factor. The rating is *slight* if mortality is expected to be between 0 and 25 percent; *moderate* if between 25 and 50 percent; and *severe* if more than 50 percent.

Windthrow hazard measures the effect of soils on root development and the ability of the soil to hold trees firmly. The hazard is *slight* if effective rooting depth is 20 inches or more and the tree withstands most storms. It is *moderate* if effective rooting depth is 10 inches to 20 inches and some trees are blown down during periods of excessive wetness and strong winds. The hazard is *severe* if effective rooting depth is less than 10 inches to bedrock or less than 15 inches to a fragipan or claypan and trees will not stand alone in strong winds.

Plant competition is the invasion or growth of unwanted shrubs, trees, or other plants when openings are made in the canopy by fire, logging, or other factors. A rating of *slight* means that competing plants do not prevent the natural regeneration or the early growth of desirable species or do not interfere with the growth of planted seedlings. A rating of *moderate* means that competing plants delay natural or artificial regeneration, but do not prevent the growth of a normal, fully stocked stand. A rating of *severe* means that competing plants prevent adequate natural restocking or natural regeneration unless intensive site preparation and such practices as weeding are used to control undesirable plants.

Table 3 gives the management concerns, the important trees, the site indexes, and the trees suitable for planting for each woodland group in the county. The site index figures in table 3 refer to the first species listed under "Important trees." The woodland group for each soil in the county is listed in the Guide to Mapping Units.

Landscaping and windbreaks [4]

The soils in Washtenaw County are grouped according to their suitability for general types of shrubs and trees suitable for landscape plantings and windbreaks. Each group is made up of soils that are suited to similar kinds of shrubs and trees. Table 4 lists for each group the suitable trees and shrubs, the height at 20 years, the shape, and the shade tolerance. The woody plant group for each individual soil is shown in the "Guide to Mapping Units."

Plantings can be used for controlling erosion, for farm and home windbreaks (fig. 16), for landscaping building sites (fig. 17, top), for establishing areas of wildlife food and cover, and for beautification (fig. 17, bottom).

Success in establishing the plants can be expected if the area is properly prepared before planting and unwanted competing plants are controlled for at least 2 years, or until the desired plants are established. The plants listed in each group are some of those commonly used; others may also be suitable. Some of the plants are shown in more than one group because they are suitable for several purposes. Many plantings provide wildlife food and cover as well as windbreaks and environmental improvement.

Wildlife [5]

A proper balance of soil, water, and plants is required to produce suitable wildlife habitat and is the most effective way to maintain and improve wildlife populations.

Table 5 rates the soils according to their level of suitability for elements of wildlife habitat and for general kinds of wildlife. A rating of *good* means that habitat is easily improved, maintained, or created, that there are few or no soil limitations to habitat management, and that satisfactory results can be expected. A *fair* rating indicates that habitat can be improved, maintained, or created on these soils, but moderate soil limitations affect habitat management or development. A moderate intensity of management and fairly frequent attention may be required to insure satisfactory results. A rating of *poor* means that habitat can be improved, maintained, or created on these soils, but the soil limitations are severe. Habitat management may be difficult and expensive and require intensive effort. Results are questionable. A rating of *very poor* indicates that under the prevailing soil conditions it is impractical to attempt to improve, maintain, or create habitats. Unsatisfactory results are probable.

The soils are rated according to their suitability for the following seven elements of wildlife habitat:

1. *Grain and seed crops* are domestic grain or other seed-producing annuals planted to produce wildlife food. Examples include corn, wheat, oats, rye, barley, buckwheat, millet, sorghum, soybeans, and sunflowers.
2. *Domestic grasses and legumes* are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are fescue, timothy, bromegrass, clover, orchardgrass, bluegrass, trefoil, alfalfa, crownvetch, switchgrass, sudangrass, and reed canarygrass.
3. *Wild herbaceous plants* are the native or naturally established herbaceous grasses and forbs, including weeds, commonly grown on upland areas, that provide food and cover for wildlife. Among these are goldenrod, ragweed, nightshade, strawberry, lambsquarters, dandelions, wintergrass, and native grass.
4. *Hardwood trees* are nonconiferous or deciduous trees and associated woody understory plants that pro-

[4] JACQUES J. PINKARD, forester, Soil Conservation Service, helped prepare this section.

[5] By CHARLES M. SMITH, biologist, Soil Conservation Service.

Figure 17.—Top: Landscaped area of Miami loam. Bottom: Tartarian honeysuckle hedge on Miami loam.

TABLE 3.—*Woodland*

[Fill land (Fd), Made land (Mb) are not listed. Material is too variable]

Woodland group and map symbols	Management concerns					Important trees	Site index	Trees for planting
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition			
Group 1o1: Fox: FoA, FoB, FoC, FoD. Kendallville: KeB, KeC. Kidder: KrB, KrC, KrD. Miami: MmB, MmC, MmD. Owosso: OwB, OwC. Riddles: RdB, RdC. Seward: SeB, SeC. Seward variant: SfB. Sisson: SnB, SnC.	Slight	Slight	Slight	Slight	Moderate.	Northern red oak Sugar maple White oak Yellow-poplar	70	Black walnut, eastern white pine, red pine, yellow-poplar.
Group 1r1: Fox: FoE. Miami: MmE, MmF.	Moderate	Moderate	Slight	Slight	Moderate.	Northern red oak Sugar maple White oak Yellow-poplar	70	Black walnut, eastern white pine, red pine, yellow-poplar.
Group 2c1: Nappanee: NaA, NaB. St. Clair: StB, StC, StD.	Slight	Slight	Slight to moderate.	Slight	Moderate to severe.	Northern red oak White ash Red maple	66	Eastern white pine, white spruce.
Group 2c2: St. Clair: StE.	Moderate	Moderate	Moderate	Slight	Moderate.	Northern red oak White ash Red maple	66	Eastern white pine, white spruce.
Group 2f3: Fox variant: FpB, FpC, FpD.	Slight	Slight	Moderate	Slight	Slight.	Northern red oak White oak American beech	65	Red pine, eastern white pine.
Group 2o2: Morley: MoB, MoC, MoD.	Slight	Slight	Slight	Slight	Moderate.	Northern red oak Black walnut Yellow-poplar	66	Black walnut, red pine.
Group 2o4: Blount: BbA, BbB. Conover: CoB, CpA. For Brookston part of CpA, see group 2w1. Dixboro: DoA. Kibbie: KnA. Macomb: MaA. Matherton: MdA. Metamora: MfA. Ypsi: YpA.	Slight	Moderate	Slight	Slight	Severe.	Northern red oak White oak Pin oak American basswood	66	White spruce, eastern white pine, Norway spruce.
Group 2r2: Morley: MoE.	Moderate	Moderate	Moderate	Slight	Moderate.	Northern red oak Black walnut Yellow-poplar	66	Black walnut, red pine.
Group 2s5: Boyer: BnB, BnC, BnD. Oakville: OaB, OaC. Oshtemo: OsB, OsC. Spinks: SpB, SpC, SpD, SrB.	Slight	Slight	Slight	Slight	Slight.	Northern red oak White oak American basswood Sugar maple	66	Red pine, eastern white pine.

TABLE 3.—*Woodland*—Continued

Woodland group and map symbols	Management concerns					Important trees	Site index	Trees for planting
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition			
Group 2s6: Boyer: BnE, BnF, BoE. For Kidder part of BoE, see group 1o1. Spinks: SpE.	Moderate - Severe if slope is more than 35 percent.	Moderate - Severe if slope is more than 35 percent.	Moderate - Severe if slope is more than 35 percent.	Slight	Moderate.	Northern red oak White oak American basswood Sugar maple	66	Red pine, eastern white pine.
Group 2w1: Brookston: Br. Cohoctah: Cc. Hoytville: Ho. Pewamo: Pe. Sebewa: Sb. Sloan: So. Wauseon: Ws.	Slight	Severe	Severe	Moderate -	Severe.	Red maple White ash Silver maple American basswood	66	Eastern white pine, white spruce, black spruce.
Group 3s3: Tedrow: TeA. Thetford: ThA. Wasepi: WaA.	Slight	Slight	Moderate -	Slight	Moderate.	Aspen Sugar maple Northern red oak White ash	60	White spruce, eastern white pine, Norway spruce.
Group 3w1: Gilford: Gf. Lamson-Colwood: Ln. Pella: Pc.	Slight	Severe	Severe	Severe	Severe.	Red maple White ash American basswood Pin oak	56	White spruce, Norway spruce, white ash, eastern cottonwood.
Group 4w2: Adrian: Ad. Edwards: Ed. Edwards variant: Ee. Houghton: Hn. Palms: Pa.	Slight	Severe	Severe	Severe	Severe.	Red maple Tamarack White ash American basswood Aspen	46	None.[1]
Group 5w1: Granby: Gr.	Slight	Severe	Severe	Severe	Severe.	Quaking aspen Silver maple Pin oak American sycamore	45	None.[1]

[1] Not planted for commercial tree production.

vide wildlife cover or that produce nuts, buds, catkins, sprouts, twigs, bark, or foliage used for food by wildlife. Representative species are maple, beech, oak, poplar, birch, willow, cherry, ash, walnut, elm, hawthorn, basswood, and serviceberry.

5. *Coniferous plants* are cone-bearing trees, shrubs, or groundcover that furnish wildlife cover or food in the form of browse, seeds, or fruit-like cones. They may be planted or transplanted or are commonly established through natural processes. Included are pine, spruce, hemlock, fir, cedar, larch, juniper, and yew.

6. *Wetland plants* are annual or perennial wild herbaceous plants of moist to wet sites, exclusive of submerged or floating aquatics, that produce food or cover used extensively by wetland forms of wildlife. Examples are smartweed, wild millet, rushes, sedges, reeds, wildrice, cattail, arrowhead, pickerelweed, and water plantain.

7. *Shallow water areas* (fig. 18) are areas having an average depth of less than 5 feet. They may be naturally wet areas or those created by dams or levees or by water-control devices in marshes and streams.

TABLE 4.—*Suitable trees and shrubs for landscaping and windbreaks*

[Suitable plants for windbreaks are identified by an asterisk]

Woody plant group and map symbols	Suitable trees and shrubs	Height in feet at 20 years	Shape	Shade tolerant
Group 1:				
Adrian: Ad.	American cherrybush*	10	Oval	No.
Edwards: Ed.	Amur privet*	12	Round	No.
Edwards variant: Ee.	Austrian pine*	22	Pyramidal	No.
Houghton: Hn.	Eastern hemlock*	20	Pyramidal	Yes.
Palms: Pa.	Eastern white pine*	22	Pyramidal	Yes.
	Green ash*	37	Oval	No.
	Laurel willow*	24	Oval	No.
	Northern white-cedar*	29	Columnar	Yes.
	Nannyberry viburnum*	18	Round	No.
	Norway spruce*	27	Conical	No.
	Red maple	46	Oval	Yes.
	Redosier dogwood	9	Mound	Some.
	Scotch pine*	31	Pyramidal	No.
	Silky dogwood*	9	Round	No.
	Tamarack*	16	Conical	No.
	Tartarian honeysuckle*	15	Round	No.
	Vanhoutte spirea*	7	Round	No.
	White spruce*	13	Conical	Some.
Group 2:				
Blount: BbA, BbB.	American basswood	30	Round	Some.
Conover: CoB, CpA.	American cranberrybush*	8	Oval	No.
For Brookston part of CpA, see group 5.	Amur privet*	11	Round	No.
	Austrian pine*	22	Pyramidal	No.
Dixboro: DoA.	Black walnut	26	Round	Some.
Kibbie: KnA.	Blue spruce*	9	Conical	No.
Macomb: MaA.	Eastern redcedar	14	Conical	No.
Matherton: MdA.	Eastern white pine*	24	Pyramidal	Yes.
Metamora: MfA.	Green ash*	39	Oval	No.
Nappanee: NaA, NaB.	Late lilac*	12	Oval	No.
St. Clair: StB, StC, StD, StE.	Laurel willow*	29	Oval	No.
Tedrow: TeA.	Northern white-cedar*	23	Columnar	Yes.
Thetford: ThA.	Norway spruce*	26	Conical	Some.
Wasepi: WaA.	Red maple	46	Oval	Some.
Ypsi: YpA.	Red pine*	26	Pyramidal	No.
	Siberian crabapple	25	Vase	No.
	Silky dogwood	10	Round	No.
	Tallpurple willow	25	Oval	No.
	Tartarian honeysuckle*	12	Round	No.
	Vanhoutte spirea*	7	Round	No.
	White ash*	39	Round	No.
	White spruce*	14	Conical	Some.
	Whitebelle honeysuckle*	10	Round	No.
Group 3:				
Boyer: BnB, BnC, BnD, BnE, BnF, BoE.	American mountain ash*	23	Oval	No.
For Kidder part of BoE, see Group 4.	Amur privet*	10	Round	No.
	Autumn-olive*	10	Oval	No.
Oakville: OaB, OaC.	Creeping juniper	1	Flat	No.
Oshtemo: OsB, OsC.	Eastern redcedar*	20	Conical	No.
Spinks: SpB, SpC, SpD, SpE, SrB.	Eastern white pine*	28	Pyramidal	Yes.
	Hawthorn*	20	Round	No.
	Jack pine*	33	Oval	No.
	Lilac*	12	Mound	Some.
	Paper birch	30	Oval	Some.
	Red pine*	30	Pyramidal	No.
	Scotch pine*	30	Pyramidal	No.
	Siberian crabapple*	18	Vase	No.
	Tartarian honeysuckle*	8	Round	No.
	Vanhoutte spirea*	6	Round	No.
	White spruce*	12	Pyramidal	Some.

TABLE 4.—*Suitable trees and shrubs for landscaping and windbreaks*—Continued

Woody plant group and map symbols	Suitable trees and shrubs	Height in feet at 20 years	Shape	Shade tolerant
Group 4:				
Fox: FoA, FoB, FoC, FoD, FoE, FpB, FpC, FpD.	American basswood	35	Round	Some.
Kendallville: KeB, KeC.	Amur privet*	12	Round	No.
Kidder: KrB, KrC, KrD.	Austrian pine	25	Pyramidal	No.
Miami: MmB, MmC, MmD, MmE, MmF.	Autumn-olive*	15	Oval	No.
Morley: MoB, MoC, MoD, MoE.	Black walnut	23	Round	Yes.
Owosso: OwB, OwC.	Eastern white pine*	28	Pyramidal	Yes.
Riddles: RdB, RdC.	Flowering dogwood	13	Flattop	Yes.
Seward: SeB, SeC, SfB.	Green ash	49	Oval	No.
Sisson: SnB, SnC.	Hackberry	28	Pyramidal	Some.
	Juneberry*	12	Oval	Yes.
	Late lilac*	14	Oval	No.
	Laurel willow*	25	Oval	No.
	Lilac*	14	Oval	Yes.
	Northern pin oak*	28	Pyramidal	No.
	Northern white-cedar*	19	Columnar	Yes.
	Norway spruce*	26	Conical	No.
	Red pine*	22	Pyramidal	No.
	Scotch pine*	31	Pyramidal	No.
	Shagbark hickory	30	Oval	Some.
	Silky dogwood	9	Round	No.
	Tartarian honeysuckle*	7	Round	No.
	White spruce*	20	Conical	Yes.
	Vanhoutte spirea*	7	Round	No.
	Whitebelle honeysuckle*	9	Round	No.
Group 5:				
Brookston: Br.	American elder	9	Round	No.
Cohoctah: Cc.	American sycamore	27	Round	Yes.
Gilford: Gf.	Amur privet*	8	Round	No.
Granby: Gr.	Arrowwood*	12	Round	No.
Hoytville: Ho.	Black cherry	40	Oval	Some.
Lamson-Colwood: Ln.	Eastern hemlock	21	Pyramidal	Yes.
Pella: Pc.	Eastern white pine*	17	Pyramidal	Yes.
Pewamo: Pe.	Green ash	25	Oval	No.
Sebewa: Sb.	Hawthorn*	15	Round	No.
Sloan: So.	Laurel willow*	22	Oval	No.
Wauseon: Ws.	Northern white-cedar*	21	Columnar	Yes.
	Norway spruce*	25	Conical	No.
	Paper birch	31	Oval	Some.
	Siberian crabapple*	15	Vase	No.
	Silky dogwood*	8	Round	No.
	Tamarack*	16	Pyramidal	No.
	White spruce	10	Pyramidal	No.
	Whitebelle honeysuckle*	10	Round	No.

Examples are muskrat marshes, waterfowl feeding areas, wildlife ponds, and beaver ponds.

The ratings shown in table 5 apply to wildlife in general and not to a specific species. Not considered, therefore, are present land use, existing vegetation, and the extent of artificial drainage provided, because these factors are subject to change.

Following are descriptions of the kinds of wildlife and representative species.

1. *Openland wildlife* are birds and mammals of croplands, pastures, meadows, lawns, and areas overgrown with grasses, herbs, shrubs, and vines. Examples are bobwhite quail, ring-necked pheasant, meadowlark, field sparrow, killdeer, cottontail rabbit, red fox, woodchuck, and sharp-tailed grouse.

2. *Woodland wildlife* are birds and mammals of wooded areas of either hardwood or coniferous trees and shrubs, or a mixture of both. Examples are ruffed grouse, wild turkey, raccoon, white-tailed deer, woodcock, thrushes, vireos, woodpeckers, tree squirrels, gray fox, porcupine, warblers, nuthatches, and owls.

3. *Wetland wildlife* (fig. 19) are birds and mammals of swampy, marshy, or open-water areas. Examples are ducks, geese, herons, bitterns, rails, kingfishers, cranes, muskrat, mink, beaver, and otter.

Recreation

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table

Figure 18.—Shallow water on Houghton muck in foreground. Houses are on Miami loam.

6 the soils of Washtenaw County are grouped and rated according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails.

Figure 19.—Ponded Houghton muck.

In table 6 the soil limitations for the specified use are expressed as *slight*, *moderate*, or *severe*. For all of these ratings, it is assumed that a good plant cover can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little site preparation is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, no flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Picnic areas (fig. 20) are attractive natural or landscaped tracts. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry, are free from flooding during

TABLE 5.—*Wildlife*

[Fill land (Fd) and Made land (Mb) are

Soil series and map symbols	Potential for habitat elements			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees
Adrian: Ad	Poor [1]	Poor	Poor	Poor
Blount:				
BbA	Fair [1]	Good	Good	Good
BbB	Fair [1]	Good	Good	Good
Boyer:				
BnB, BnC, BnD, BnE, BoE	Poor	Fair	Good	Good
Rating also applies to Kidder soil in BoE.				
BnF	Very poor	Fair	Good	Good
Brookston: Br	Good [1]	Poor	Poor	Poor
Cohoctah: Cc	Poor	Fair	Fair	Fair
Colwood	Good [1]	Fair	Fair	Fair
Mapped only with Lamson soils.				
Conover:				
CoB	Good [1]	Good	Good	Good
CpA	Good [1]	Good	Good	Good
For Brookston part of CpA, see Brookston series.				
Dixboro: DoA	Good [1]	Good	Good	Good
For Kibbie part of DoA, see Kibbie series.				
Edwards: Ed	Very poor	Poor	Poor	Poor
Edwards variant: Ee	Very poor	Poor	Poor	Poor
Fox:				
FoA, FoB	Good	Good	Good	Good
FoC, FoD	Fair	Good	Good	Good
FoE	Poor	Fair	Good	Good
Fox variant:				
FpB	Poor	Fair	Fair	Poor
FpC, FpD	Poor	Fair	Fair	Poor
Gilford: Gf	Fair [1]	Poor	Poor	Poor
Granby: Gr	Poor	Fair	Fair	Fair
Houghton: Hn	Fair [1]	Poor	Poor	Poor
Hoytville: Ho	Good [1]	Poor	Poor	Poor
Kendallville:				
KeB	Fair	Good	Good	Good
KeC	Fair	Good	Good	Good
Kibbie: KnA	Good [1]	Good	Good	Good
Kidder:				
KrB	Good	Good	Good	Good
KrC, KrD	Fair	Good	Good	Good
Lamson: Ln	Good [1]	Good	Good	Good
For Colwood part, see Colwood series.				
Macomb: MaA	Good [1]	Good	Good	Good
Matherton: MdA	Good [1]	Good	Good	Good

habitat

not listed. Material is too variable]

Potential for habitat elements—Continued			Potential as habitat for kinds of wildlife		
Coniferous plants	Wetland plants	Shallow water areas	Openland	Woodland	Wetland
Poor	Good	Good	Poor	Poor	Good.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Poor	Good	Good	Fair	Poor	Good.
Poor	Good	Good	Fair	Fair	Good.
Fair	Good	Good	Fair	Fair	Good.
Fair	Poor	Poor	Good	Good	Poor.
Fair	Fair	Fair	Good	Good	Fair.
Good	Fair	Fair	Good	Good	Fair.
Poor	Good	Good	Very poor	Poor	Good.
Poor	Good	Good	Very poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Fair	Fair	Good	Fair	Fair	Fair.
Poor	Good	Good	Poor	Poor	Good.
Poor	Good	Good	Fair	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Fair	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Fair	Fair	Poor	Good	Good	Poor.
Fair	Fair	Poor	Good	Good	Poor.
Fair	Fair	Poor	Good	Good	Poor.

TABLE 5.—*Wildlife*

Soil series and map symbols	Potential for habitat elements			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees
Metamora: MfA	Good [1]	Good	Good	Good
Miami:				
MmB	Good [1]	Good	Good	Good
MmC, MmD	Fair	Good	Good	Good
MmE	Poor	Fair	Good	Good
MmF	Very poor	Fair	Good	Good
Morley:				
MoB	Good	Good	Good	Good
MoC, MoD	Fair	Good	Good	Good
MoE	Poor	Fair	Good	Good
Nappanee:				
NaA	Good [1]	Good	Fair	Good
NaB	Good [1]	Good	Fair	Good
Oakville:				
OaB	Poor	Poor	Fair	Fair
OaC	Poor	Poor	Fair	Fair
Oshtemo:				
OsB	Poor	Fair	Good	Good
OsC	Poor	Fair	Good	Good
Owosso:				
OwB	Good	Good	Good	Good
For Miami part of OwB, see MmB in Miami series.				
OwC	Fair	Good	Good	Good
For Miami part of OwC, see MmC in Miami series.				
Palms: Pa	Very poor	Poor	Poor	Poor
Pella: Pc	Good [1]	Poor	Poor	Poor
Pewamo: Pe	Good [1]	Fair	Fair	Fair
Riddles:				
RdB	Good	Good	Good	Good
RdC	Fair	Good	Good	Good
Sebewa: Sb	Good [1]	Poor	Poor	Poor
Seward:				
SeB	Poor	Fair	Good	Good
SeC	Poor	Fair	Good	Good
Seward variant: SfB	Good	Good	Good	Good
Sisson:				
SnB	Good	Good	Good	Good
SnC	Fair	Good	Good	Good
Sloan: So	Poor	Poor	Poor	Poor
Spinks:				
SpB, SrB	Poor	Fair	Good	Good
For Oshtemo part of SrB, see OsB in Oshtemo series.				
SpC, SpD, SpE	Poor	Fair	Good	Good
St. Clair:				
StB	Good	Good	Good	Good
StC, StD	Fair	Good	Good	Good
StE	Poor	Fair	Good	Good

habitat—Continued

Potential for habitat elements—Continued			Potential as habitat for kinds of wildlife		
Coniferous plants	Wetland plants	Shallow water areas	Openland	Woodland	Wetland
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Poor	Good	Good	Fair	Poor	Good.
Fair	Good	Good	Fair	Fair	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.

TABLE 5.—*Wildlife*

Soil series and map symbols	Potential for habitat elements			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees
Tedrow: TeA	Poor	Fair	Good	Fair
Thetford: ThA	Poor	Fair	Good	Good
Wasepi: WaA	Good [1]	Good	Good	Good
Wauseon: Ws	Good [1]	Poor	Poor	Poor
Ypsi: YpA	Good [1]	Good	Good	Good

[1] It is assumed that drainage is feasible.

the season of use, and do not have slopes or stones that greatly increase cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrop, good drainage, no flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet

Figure 20.—Recreation area on Cohoctah fine sandy loam, frequently flooded.

habitat—Continued

Potential for habitat elements—Continued			Potential as habitat for kinds of wildlife		
Coniferous plants	Wetland plants	Shallow water areas	Openland	Woodland	Wetland
Fair	Fair	Fair	Fair	Fair	Fair.
Good	Fair	Fair	Fair	Good	Fair.
Good	Fair	Fair	Good	Good	Fair.
Poor	Good	Good	Poor	Poor	Good.
Good	Fair	Fair	Good	Good	Fair.

but not dusty when dry, are flooded no more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Engineering [6]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building drainage systems, and systems for disposing of sewage. Among the soil properties most important to engineers are permeability, shear strength, compaction characteristics, drainage, shrink-swell characteristics, grain size, plasticity, and reaction. Also important are depth to water table, flood hazard, and relief.

The information in this section can be helpful to those who—

1. Select and develop sites for industry, business, residences, and recreational facilities.
2. Plan farm drainage structures, dams, and other structures for conserving soil and water; locate suitable routes for underground conduits and cables; and locate sites for sewage disposal fields.
3. Select locations for highways (fig. 21), airports, pipelines, and sewage disposal fields, and plan detailed surveys of the soils at the selected locations.
4. Locate sources of sand, gravel, and other material for use in construction.
5. Correlate pavement performance with the soil mapping units and thus develop information that will be useful in designing and maintaining the pavements.
6. Supplement other publications, such as maps, reports, and aerial photographs, that are used in preparation of engineering reports for a specific area.
7. Determine suitability of soils for movement of vehicles and construction equipment.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

It should be emphasized that the interpretations made in this soil survey are not a substitute for the sampling and testing needed at a site chosen for a specific engineering work that involves heavy loads, or at a site where excavations are to be deeper than the depths of the layers here reported. The estimates reported in this publication are generally to a depth of about 5 feet and normally do not apply to greater depths.

The mapping units shown on the maps in this survey may include small areas of different soil materials. These inclusions may be as much as 2 acres in size, but are too small to be mapped separately. They generally are not significant to the farming in the area, but may be important in engineering planning.

Information of value in planning engineering work is given throughout the text, particularly in the sections

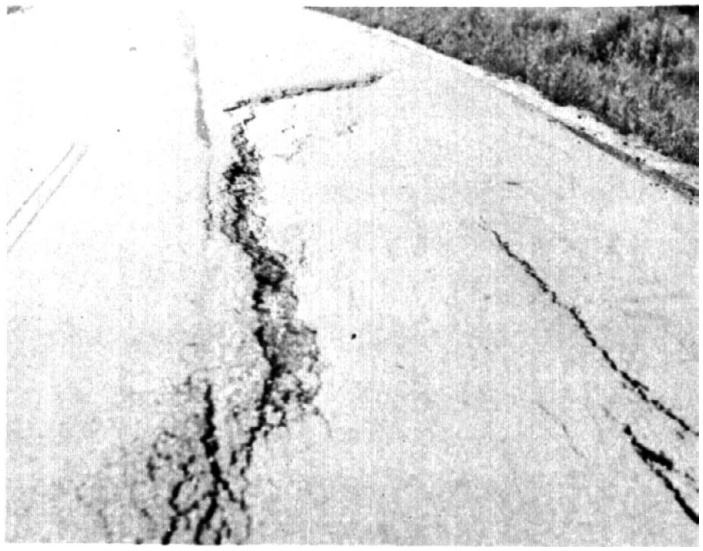

Figure 21.—Damaged pavement on Houghton muck.

[6] KEITH I. BAKEMAN, civil engineer, Soil Conservation Service, assisted in preparing this section.

TABLE 6.—*Estimated degree and kinds of limitations for recreation*

[No estimate for Fill land and Made land because they are too variable]

Recreation group	Camp areas	Picnic areas	Playgrounds	Paths and trails
Group 1: Adrian: Ad. Edwards: Ed. Edwards variant: Ee. Houghton: Hn. Palms: Pa.	Severe: wet; floods; excess humus.	Severe: wet; floods; excess humus.	Severe: wet; floods; excess humus.	Severe: wet; floods; excess humus.
Group 2: Blount: BbA, BbB. Ypsi: YpA.	Moderate: wet; percs slowly.	Moderate: wet ------	Moderate: wet percs slowly	Moderate: wet.
Group 3: Boyer: BnB. Oshtemo: OsB. Seward: SeB. Spinks: SpB, SrB.	Moderate: too sandy--	Moderate: too sandy--	Moderate: too sandy; slope.	Moderate: too sandy.
Group 4: Boyer: BnC. Oshtemo: OsC. Seward: SeC. Spinks: SpC.	Moderate: too sandy; slope.	Moderate: too sandy; slope.	Severe: slope --------	Moderate: too sandy.
Group 5: Boyer: BnD, BnE. Boyer-Kidder: BoE. Spinks: SpD, SpE.	Severe: slope --------	Severe: slope --------	Severe: slope --------	Moderate: too sandy.
Group 6: Boyer: BnF. Miami: MmF.	Severe: slope --------	Severe: slope --------	Severe: slope --------	Severe: slope.
Group 7: Brookston: Br. Gilford: Gf. Granby: Gr. Hoytville: Ho. Lamson-Colwood: Ln. Pella: Pc. Pewamo: Pe. Sebewa: Sb. Wauseon: Ws.	Severe: wet ---------	Severe: wet ---------	Severe: wet ---------	Severe: wet.
Group 8: Cohoctah: Cc. Sloan: So.	Severe: wet; floods --	Severe: wet; floods --	Severe: wet; floods --	Severe: wet; floods.
Group 9: Conover: CoB, CpA. For Brookston part of CpA, see group 7. Macomb: MaA. Metamora: MfA.	Severe: wet ---------	Moderate: wet ------	Severe: wet ---------	Moderate: wet.
Group 10: Fox: FoA.	Slight ----------	Slight ----------	Slight ----------	Slight.
Group 11: Fox: FoB. Kendallville: KeB. Kidder: KrB. Miami: MmB. Owosso-Miami: OwB. Riddles: RdB. Sisson: SnB.	Slight ----------	Slight ----------	Moderate: slope -----	Slight.
Group 12: Fox: FoC. Kendallville: KeC. Kidder: KrC. Miami: MmC. Owosso-Miami: OwC. Riddes: RdC. Sisson: SnC.	Moderate: slope -----	Moderate: slope -----	Severe: slope --------	Slight.

TABLE 6.—*Estimated degree and kinds of limitations for recreation*—Continued

Recreation group	Camp areas	Picnic areas	Playgrounds	Paths and trails
Group 13: Fox: FoD, FoE. Kidder: KrD. Miami: MmD, MmE. Morley: MoD, MoE.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Group 14: Fox variant: FpB.	Moderate: small stones.	Moderate: small stones.	Severe: small stones	Moderate: small stones.
Group 15: Fox variant: FpC, FpD.	Moderate: small stones; slope.	Moderate: small stones; slope.	Severe: small stones; slope.	Moderate: small stones.
Group 16: Dixboro-Kibbie: DoA. Kibbie: KnA. Matherton: MdA. Wasepi: WaA.	Moderate: wet	Moderate: wet	Moderate: wet; slope.	Moderate: wet.
Group 17: Morley: MoB. Seward variant: SfB.	Moderate: percs slowly.	Slight	Moderate: percs slowly; slope.	Slight.
Group 18: Morley: MoC.	Moderate: percs slowly; slope.	Moderate: slope	Severe: slope	Slight.
Group 19: Nappanee: NaA, NaB.	Severe: percs slowly; wet.	Moderate: wet; too clayey.	Severe: percs slowly; wet.	Moderate: wet; too clayey.
Group 20: Oakville: OaB, OaC.	Moderate: too sandy; soil blowing.	Moderate: too sandy; soil blowing.	Severe: too sandy; soil blowing; slope.	Severe: too sandy.
Group 21: St. Clair: StB.	Severe: percs slowly	Moderate: too clayey	Severe: percs slowly	Moderate: too clayey.
Group 22: St. Clair: StC, StD.	Severe: percs slowly	Moderate: too clayey; slope.	Severe: percs slowly; slope.	Moderate: too clayey.
Group 23: St. Clair: StE.	Severe: percs slowly; slope.	Severe: slope	Severe: percs slowly; slope.	Severe: slope.
Group 24: Tedrow: TeA. Thetford: ThA.	Moderate: too sandy; wet.	Moderate: wet; too sandy.	Severe: wet; too sandy.	Moderate: wet; too sandy.

"Descriptions of the Soils" and "Formation and Classification of Soils."

Some of the terms used in soil science may be unfamiliar to engineers, and some words, for example, soil, clay, silt, and sand, may have special meanings in soil science. These and other special terms used in the soil survey are defined in the Glossary at the back of this survey. Most of the information about engineering is given in tables 7, 8, and 9.

Engineering soil classification systems

Agricultural scientists of the United States Department of Agriculture classify soils according to texture. In some ways this system of naming textural classes is comparable to the systems most commonly used by engineers for classifying soils; that is, the system of the American Association of State Highway and Transportation Officials (AASHTO) and the Unified system.

Most highway engineers classify soil material in accordance with the system approved by the American Association of State Highway and Transportation Officials (*1*). In this system soil material is classified in seven principal groups. The groups range from A–1, which consists of gravelly soils that have high bearing capacity and are the best soils for subgrade, to A–7, which consists of clayey soils that have low strength when wet and are the poorest soils for subgrade.

Some engineers prefer to use the Unified soil classification system (*8*). In this system soil material is identified according to texture, plasticity, and performance as construction material. Soil material is identified as coarse grained (GW, GP, GM, GC, SW, SP, SM, and SC), fine grained (ML, CL, OL, MH, CH, and OH), and highly organic (Pt).

Soil properties significant in engineering

Listed in table 7 are the soil series, the symbols for most mapping units, and the estimates of properties significant in engineering. The estimated properties are those of the representative soil. Where test data are available, that information is used. Where test data are not available, the estimates shown are based on comparisons of the soils in Washtenaw County with similar soils tested in other counties.

Depth to the seasonal high water table is the maximum height to which the water table rises during the

TABLE 7.—*Estimates of soil properties*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Percent coarse fraction greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Adrian: Ad	0–1	0–26	Muck (sapric)	Pt		0
		26–60	Gravelly sand	SP, SM–SP	A–1	0
Blount: BbA, BbB	1.5–2.0	0–10	Loam	ML, CL	A–4	0–5
		10–30	Heavy clay loam and clay	CL, CH	A–6, A–7	0–5
		30–60	Clay loam	CL	A–6	0–5
*Boyer: BnB, BnC, BnD, BnE, BnF, BoE. For Kidder part of BoE, see Kidder series.	>5	0–18	Loamy sand	SM	A–2	0–5
		18–32	Sandy loam and heavy sandy loam.	SM, SC	A–2, A–4, A–6	0–5
		32–60	Gravelly coarse sand	SP, SP–SM	A–1, A–3	0–5
Brookston: Br	0–1	0–11	Loam	ML, CL	A–4	0–5
		11–36	Clay loam and silty clay loam.	CL	A–6	0–5
		36–60	Loam	ML, CL	A–4, A–6	0–5
Cohoctah: Cc	0–1	0–60	Sandy loam, fine sandy loam, and loam.	SM–SC, ML	A–2, A–4	0
Colwood Mapped only with Lamson soils.	0–1.5	0–12	Loam	ML	A–4	0
		12–32	Clay loam, sandy clay loam	CL–ML	A–4, A–6	0
		32–60	Fine sand, very fine sand, and silt loam.	SM, ML	A–4, A–2	0
*Conover: CoB, CpA For Brookston part of CpA, see Brookston series.	1.0–2.0	0–11	Loam	ML, CL	A–4	0–5
		11–27	Clay loam, silty clay loam	CL	A–6	0–5
		27–60	Loam	ML	A–4, A–6	0–5
*Dixboro: DoA For Kibbie part, see Kibbie series.	1.5–2.0	0–11	Fine sandy loam	SM, ML	A–4	0
		11–23	Fine sandy loam	SM, ML	A–4	0
		23–60	Stratified fine sand, very fine sandy loam, fine sandy loam, and silt loam.	SM, ML	A–2–4, A–4	0
Edwards: Ed	0–0.5	0–32	Muck (sapric)	Pt		0
		32–60	Marl			0
Edwards variant: Ee	<0.5	0–9	Muck (sapric)	Pt		0
		9–60	Marl			0
Fill land: Fd. No reliable estimates, material too variable.						
Fox: FoA, FoB, FoC, FoD, FoE	>5	0–22	Sandy loam, gravelly sandy loam.	SM, SM–SC	A–2	0–5
		22–39	Gravelly sandy clay loam, gravelly clay loam.	SC, CL	A–4, A–6	0–5
		39–60	Gravelly sand	SP, SP–SM	A–1	0–10
Fox variant: FpB, FpC, FpD	>5	0–8	Cobbly sandy loam	SM, SM–SC	A–2	15–25
		8–27	Cobbly clay loam	SC, CL	A–4, A–6	10–30
		27–60	Gravelly sand	SP	A–1	10–50
Gilford: Gf	0–1	0–11	Sandy loam	SM, SM–SC	A–2	0
		11–28	Sandy loam	SM	A–2	0
		28–60	Gravelly sand	SP, SP–SM	A–1, A–3	0–5
Granby: Gr	0–1	0–60	Fine sand	SP	A–3	0
Houghton: Hn	0–1	0–60	Muck (sapric)	Pt		

significant in engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the column of the table. < means less than. > means more than]

Percentage less than 3 inches passing sieve				Liquid limit	Plasticity index	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In/hr*	*In/in of soil*	*pH*			
						6.0–10.0	0.35–0.45	5.6–7.8	High	High	Moderate.
60–100	35–100	20–40	0–10		NP	6.0–10.0	0.03–0.04	7.4–7.8	Low	High	Low.
95–100	90–100	80–95	50–75	18–38	4–9	0.6–2.0	0.20–0.22	5.6–7.3	Low	High	Moderate.
95–100	90–100	90–95	75–90	35–51	15–26	0.2–0.6	0.11–0.19	5.6–7.3	High	High	Moderate.
95–100	90–95	90–95	60–90	28–36	12–18	0.2–0.6	0.16–0.20	7.4–7.8	Moderate	High	Low.
95–100	65–95	45–70	15–30		NP	6.0–20.0	0.10–0.12	5.6–6.5	Low	Low	Moderate.
95–100	65–95	55–85	25–45	15–35	2–15	2.0–6.0	0.12–0.14	5.6–7.8	Low	Low	Moderate.
55–90	25–85	20–55	0–10		NP	>20.0	0.02–0.04	7.4–7.8	Low	Low	Low.
95–100	90–100	80–95	55–75	18–38	5–10	0.6–2.0	0.20–0.22	6.8–7.3	Low	High	Low.
95–100	90–100	85–95	60–90	29–40	11–20	0.6–2.0	0.15–0.19	6.6–7.3	Moderate	High	Low.
95–100	90–100	80–95	50–75	17–34	6–14	0.2–2.0	0.17–0.19	7.4–7.8	Low	High	Low.
100	95–100	60–85	25–60	10–30	NP–8	2.0–6.0	0.13–0.22	7.4–8.4	Low	High	Low.
	100	95–100	50–80	18–38	2–9	0.6–2.0	0.20–0.22	6.1–7.3	Low	High	Low.
	100	95–100	50–80	15–40	6–20	0.6–2.0	0.15–0.19	6.1–7.8	Moderate	High	Low.
	100	95–100	30–80	<35	NP–10	0.6–2.0	0.14–0.18	7.8–8.4	Low	High	Low.
95–100	90–100	80–95	55–90	18–37	4–10	0.6–2.0	0.20–0.22	6.1–6.5	Low	High	Moderate.
95–100	90–100	80–95	60–80	29–40	11–20	0.2–2.0	0.15–0.18	6.1–7.3	Moderate	High	Moderate.
95–100	90–100	80–95	50–75	17–34	6–14	0.2–2.0	0.14–0.16	7.8–8.4	Low	High	Low.
100	100	70–95	40–65	<20	2–6	2.0–6.0	0.16–0.22	5.6–7.3	Low	Moderate	Moderate.
100	100	70–95	40–90	<20	2–10	0.6–2.0	0.10–0.20	5.6–7.8	Low	Moderate	Moderate.
100	95–100	70–95	20–80	<20	NP–8	0.6–2.0	0.07–0.20	7.4–7.8	Low	Moderate	Low.
						6.0–10.0	0.35–0.45	5.6–7.8	High	High	Low.
100	95–100	80–90	60–80					7.4–7.8	High	High	Low.
						6.0–10.0	5.6–7.8	6.6–7.8	High	High	Low.
								7.4–7.8	High	High	Low.
85–100	60–95	55–90	20–30	20–29	2–7	2.0–6.0	0.12–0.14	5.6–6.6	Low	Low	Low.
70–95	65–95	55–85	40–80	25–40	9–25	0.6–2.0	0.12–0.17	6.6–7.8	Low	Low	Low.
40–95	30–80	20–30	0–10		NP	6.0–20.0	0.02–0.04	7.4–7.8	Low	Low	Low.
80–90	70–90	60–80	15–25	20–29	2–7	2.0–6.0	0.07–0.13	6.1–7.3	Low	Low	Low.
80–90	70–85	50–70	40–60	25–40	9–20	0.6–2.0	0.08–0.15	6.1–7.3	Low	Low	Low.
70–90	30–50	20–40	0–10		NP	6.0–20.0	0.01–0.03	7.4–7.8	Low	Low	Low.
95–100	90–100	65–75	20–30	35–45	5–10	2.0–6.0	0.13–0.15	6.1–7.3	Low	High	Moderate.
95–100	80–100	55–70	20–30	20–29	2–8	2.0–6.0	0.12–0.14	6.1–7.3	Low	High	Moderate.
85–100	70–95	20–60	3–10		NP	6.0–20.0	0.02–0.04	7.4–7.8	Low	High	Low.
100	100	60–70	0–5		NP	6.0–20.0	0.06–0.08	6.1–7.8	Low	High	Low.
						6.0–10.0	0.35–0.45	6.6–7.8	High	High	Low.

TABLE 7.—*Estimates of soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Percent coarse fraction greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Hoytville: Ho	0–0.5	0–9	Silty clay loam	CL	A–6, A–7	0
		9–43	Clay	CH	A–7	0
		43–60	Clay	CH	A–7	0
Kendallville: KeB, KeC	>5	0–20	Loam	ML, CL	A–4	0
		20–34	Gravelly clay loam	SC, CL	A–4, A–6	0
		34–38	Gravelly loamy sand	SM	A–2	0
		38–60	Loam	CL–ML	A–4, A–6	0
Kibbie: KnA	1.5–2.0	0–12	Fine sandy loam	ML, SM	A–4	0
		12–29	Sandy clay loam, silty clay loam.	CL	A–4, A–6	0
		29–60	Fine sand, very fine sand, and silt.	SM, ML, SC	A–2, A–4	0
Kidder: KrB, KrC, KrD	>5	0–13	Sandy loam	SM, SM–SC	A–2	0–5
		13–36	Sandy clay loam, clay loam	SC, CL	A–6	0–5
		36–60	Sandy loam	SM, CM–SC	A–2, A–4	0–5
*Lamson: Ln	<1	0–9	Fine sandy loam	ML, SM, SC	A–4, A–2	0
For Colwood part of Ln, see Colwood series.		9–32	Fine sandy loam, loamy very fine sand.	SM, ML	A–4, A–2	0
		32–60	Fine sandy loam, very fine sand, silt loam.	SM, ML	A–4, A–2	0
Macomb: MaA	1–2	0–11	Loam	CL, CL–ML	A–4	0–5
		11–29	Clay loam	SC, CL	A–6	0–5
		29–33	Gravelly sand	SP	A–3, A–1	0–5
		33–60	Clay loam	CL	A–6	0–5
Made land: Mb. No reliable estimates, material too variable.						
Matherton: MdA	1.5–2.0	0–9	Sandy loam	SM	A–2, A–4	0
		9–32	Sandy clay loam, gravelly sandy clay loam.	SC, CL	A–4, A–6	0
		32–60	Sand	SP, GP, SM–SP	A–1, A–3	0–5
Metamora: MfA	1.5–2.0	0–9	Sandy loam	SM	A–2, A–4	0–5
		9–30	Sandy loam	SM, SC	A–2, A–4	0–5
		30–60	Clay loam, loam	ML, CL	A–4, A–6, A–7	0
Miami: MmB, MmC, MmD, MmE, MmF.	>4	0–11	Loam	CL–ML, CL	A–4, A–6	0
		11–30	Clay loam	CL	A–6	0
		30–60	Loam	CL–ML, CL	A–4, A–6	0
Morley: MoB, MoC, MoD, MoE	>5	0–12	Loam	CL–ML, CL	A–4, A–6	0–5
		12–28	Heavy clay loam	CL	A–6, A–7	0–5
		28–60	Clay loam	CL	A–6	0–5
Nappanee: NaA, NaB	1–2	0–8	Silty clay loam	CL	A–4, A–6	0
		8–20	Silty clay, clay	CL, CH	A–7, A–6	0–5
		20–60	Silty clay	CL, CH	A–6, A–7	0–5
Oakville: OaB, OaC	>3.5	0–60	Fine sand	SM	A–2	0
Oshtemo: OsB, OsC	>5	0–18	Loamy sand	SM	A–2	0
		18–40	Heavy sandy loam, gravelly sandy clay loam, and loamy sand.	SM, SC	A–2, A–4	0
		40–60	Loamy sand	SM, SP–SM	A–2	0
*Owosso: OwB, OwC	>4	0–25	Sandy loam	SM, SC	A–2, A–4	0
For Miami part of OwB and OwC, see Miami series.		25–60	Loam	CL–ML, CL	A–4, A–6	0–5

significant in engineering—Continued

Percentage less than 3 inches passing sieve				Liquid limit	Plasticity index	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
						In/hr	*In/in of soil*	*pH*			
95–100	95–100	90–100	85–95	36–50	15–25	0.06–0.2	0.14–0.17	6.1–7.8	Moderate	High	Low.
95–100	95–100	90–100	85–95	51–66	22–40	0.2–0.6	0.11–0.15	6.1–7.8	High	High	Low.
90–100	90–100	85–95	80–95	52–60	29–34	0.06–0.2	0.10–0.14	7.9–8.4	High	High	Low.
95–100	85–100	80–90	50–80	18–38	4–10	0.6–2.0	0.20–0.22	5.6–7.3	Low	Moderate	Moderate.
90–100	60–80	55–80	40–75	25–40	9–20	0.2–0.6	0.12–0.17	5.6–7.3	Low	Moderate	Moderate.
90–100	40–75	25–45	15–30	-------	NP	2.0–6.0	0.07–0.13	6.1–7.8	Low	Moderate	Low.
95–100	80–100	75–95	50–80	17–34	6–14	0.6–2.0	0.17–0.19	7.3–7.8	Low	Moderate	Low.
100	100	95–100	40–60	18–29	2–8	0.6–2.0	0.16–0.18	6.1–7.3	Low	High	Low.
100	100	95–100	60–80	18–40	6–20	0.6–2.0	0.17–0.20	6.1–7.3	Low	High	Low.
100	100	70–95	30–80	<25	NP–10	0.6–2.0	0.14–0.18	7.4–7.8	Low	High	Low.
95–100	90–100	80–90	20–30	20–29	2–7	2.0–6.0	0.12–0.14	5.6–7.3	Low	Moderate	Moderate.
95–100	90–100	80–90	50–80	29–40	11–20	0.6–2.0	0.15–0.19	5.6–7.8	Moderate	Moderate	Moderate.
95–100	85–100	80–90	25–40	20–30	2–8	0.6–2.0	0.11–0.13	7.4–7.8	Low	Low	Low.
100	100	85–100	25–60	15–29	2–8	0.6–2.0	0.16–0.18	6.1–7.8	Low	High	Low.
100	100	85–100	20–60	<25	NP–4	0.6–2.0	0.11–0.17	6.1–7.8	Low	High	Low.
100	100	85–100	20–65	<25	NP–4	0.6–2.0	0.11–0.17	7.4–7.8	Low	High	Low.
95–100	75–95	65–90	55–75	18–26	6–9	0.6–2.0	0.20–0.22	5.6–7.3	Low	High	Low.
95–100	75–95	70–85	40–75	30–40	12–18	0.2–0.6	0.16–0.18	5.6–7.3	Moderate	High	Low.
60–75	55–70	20–60	0–5	-------	NP	6.0–20.0	0.04–0.06	7.4–7.8	Low	High	Low.
95–100	85–95	80–95	70–80	30–45	11–18	0.2–0.6	0.14–0.16	7.4–7.8	Moderate	High	Low.
95–100	75–95	60–70	25–40	<25	NP–6	2.0–6.0	0.13–0.17	5.6–7.3	Low	High	Moderate.
95–100	65–95	55–85	35–70	25–40	9–20	0.6–2.0	0.12–0.17	5.6–7.3	Low	High	Moderate.
40–95	30–90	25–55	0–10	-------	NP	6.0–20.0	0.02–0.04	7.4–7.8	Low	High	Low.
95–100	95–100	60–80	25–45	<25	NP–7	2.0–6.0	0.14–0.18	6.1–6.5	Low	Moderate	Moderate.
95–100	95–100	60–75	30–45	15–30	2–10	2.0–6.0	0.16–0.18	5.1–7.3	Low	Moderate	Moderate.
100	95–100	90–100	70–85	25–45	6–22	0.2–0.6	0.14–0.18	6.6–7.8	Moderate	High	Low.
95–100	90–100	80–95	50–80	22–30	4–12	0.6–2.0	0.18–0.22	5.6–6.5	Low	Low	Moderate.
95–100	90–100	80–95	50–80	29–40	11–20	0.6–2.0	0.16–0.18	5.1–6.5	Moderate	Moderate	Moderate.
90–100	85–95	80–95	50–75	17–30	6–14	0.2–2.0	0.14–0.16	7.4–8.4	Low	Low	Low.
95–100	90–100	85–95	50–80	18–37	4–14	0.6–2.0	0.20–0.22	6.1–7.3	Low	Moderate	Low.
95–100	90–100	85–95	65–80	32–50	15–26	0.06–0.6	0.15–0.19	5.6–7.3	Moderate	Moderate	Moderate.
95–100	90–100	85–95	65–80	32–36	13–18	0.2–0.6	0.14–0.16	6.6–7.8	Moderate	Moderate	Low.
95–100	95–100	85–100	85–95	27–37	8–16	0.06–0.2	0.14–0.17	6.1–7.3	Moderate	High	Low.
95–100	95–100	85–100	70–95	29–70	12–42	<0.06	0.10–0.12	5.6–7.8	High	High	Low.
95–100	95–100	85–100	70–95	27–60	12–34	<0.06	0.08–0.10	7.4–7.8	High	High	Low.
100	100	70–85	20–35	-------	NP	>20.0	0.07–0.09	5.6–7.3	Low	Low	Moderate.
95–100	65–95	40–70	15–30	-------	NP	2.0–6.0	0.10–0.12	5.1–6.5	Low	Low	High.
95–100	65–95	60–80	25–45	12–30	2–10	2.0–6.0	0.09–0.14	5.1–6.5	Low	Low	High.
90–100	60–95	55–70	10–15	-------	NP	2.0–6.0	0.08–0.10	5.1–7.3	Low	Low	High.
95–100	90–100	60–80	20–40	15–30	NP–10	2.0–6.0	0.09–0.15	5.6–7.3	Low	Low	Moderate.
95–100	90–95	85–95	70–85	25–45	6–23	0.2–0.6	0.14–0.16	7.4–8.4	Moderate	Moderate	Low.

TABLE 7.—*Estimates of soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Percent coarse fraction greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Palms: Pa	0–1	0–30	Muck (sapric)	Pt		0
		30–60	Fine sandy loam, loam	ML–CL, CL	A–4, A–6	0
Pella: Pc	0–1	0–12	Silt loam	CL–ML, CL	A–4	0
		12–25	Heavy silt loam	CL–ML, CL	A–4	0
		25–60	Silt loam, silty clay loam	ML, CL	A–4	0
Pewamo: Pe	0–1.5	0–13	Clay loam	CL	A–6	0–5
		13–37	Silty clay	CL	A–6, A–7	0–5
		37–60	Silty clay loam	CL	A–6	0–5
Riddles: RdB, RdC	>5	0–17	Sandy loam	SC	A–4	0–5
		17–50	Sandy clay loam	SC, CL	A–6, A–7	0–5
		50–60	Sandy loam	SM, SC	A–4, A–2	0–5
Sebewa: Sb	0–1	0–11	Loam	ML, SM	A–4	0
		11–33	Loam and heavy loam	SC, CL	A–4, A–6	0
		33–60	Gravelly sand	SP, SM–SP, GP	A–1	0–5
Seward: SeB, SeC	2–<3	0–27	Loamy fine sand	SM	A–2	0
		27–32	Heavy sandy loam	SM, SC	A–4, A–2	0
		32–60	Clay	CH	A–7	0–5
Seward variant: SfB	>4	0–24	Sandy loam, loamy sand, sandy clay loam.	SM, SC	A–2, A–4	0
		24–60	Clay	CH	A–7	0
Sisson: SnB, SnC	>5	0–14	Fine sandy loam	CL–ML, SM	A–4	0
		14–37	Heavy fine sandy loam, clay loam.	CL, CL–ML	A–4, A–6	0
		37–60	Stratified silt loam, and very fine sand.	SM, ML	A–4	0
Sloan: So	0–1	0–18	Silt loam	ML	A–4	0
		18–48	Heavy loam, clay loam	CL–ML, CL	A–4, A–6	0–5
		48–60	Sandy loam	SM, SM–SC	A–4, A–2	0–5
*Spinks: SpB, SpC, SpD, SpE, SrB — For Oshtemo part of SrB, see Oshtemo series.	>5	0–22	Loamy sand	SM	A–2	0
		22–60	Fine sand and loamy fine sand.	SM or SP–SM	A–2, A–3	0
St. Clair: StB, StC, StD, StE	2–3	0–9	Clay loam	CL	A–4, A–6	0–5
		9–25	Clay	CH	A–7	0–5
		25–60	Clay	CH	A–7	0–5
Tedrow: TeA	1.0–2.0	0–8	Loamy sand	SM	A–2	0
		8–60	Fine sand	SM	A–2	0
Thetford: ThA	1–2	0–20	Loamy sand	SM	A–2, A–4	0
		20–38	Sand, loamy sand, sandy loam.	SM	A–2, A–3, A–4	0
		38–60	Sand	SM	A–2	0
Wasepi: WaA	1–2	0–9	Sandy loam	SM, SC	A–4, A–2–4	0
		9–33	Sandy loam, loamy sand	SM, SC	A–4, A–2–4, A–6	0–5
		33–60	Gravelly sand, sand	SP, SP–SM, GP	A–1, A–2, A–3	0–5
Wauseon: Ws	0–1	0–15	Fine sandy loam	SM, SM–SC	A–4, A–2	0
		15–33	Sandy loam	SM or SC	A–4, A–2–4	0
		33–60	Silty clay and heavy silty clay loam.	CL, CH	A–7	<5
Ypsi: YpA	1.5–2.0	0–9	Sandy loam	SM, SM–SC	A–2	0
		9–37	Sandy loam and loamy sand	SM or SC	A–2	0
		37–60	Silty clay	CH, CL	A–7	0–5

[1] Nonplastic.

significant in engineering—Continued

Percentage less than 3 inches passing sieve				Liquid limit	Plasticity index	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In/hr*	*In/in of soil*	*pH*			
						6.0–10.0	0.35–0.45	5.6–7.3	High	High	Moderate.
95–100	95–100	80–95	65–80	16–34	6–14	0.6–2.0	0.16–0.19	6.6–8.4	Low	High	Low.
100	100	90–100	70–90	25–40	5–9	0.6–2.0	0.22–0.24	6.1–7.3	Low	High	Low.
100	100	95–100	70–90	15–30	6–10	0.6–2.0	0.20–0.22	6.1–7.8	Low	High	Low.
100	100	90–100	70–85	17–27	3–10	0.6–2.0	0.18–0.22	7.4–7.8	Low	High	Low.
95–100	95–100	85–95	70–80	23–37	12–20	0.6–2.0	0.17–0.19	6.1–7.3	Moderate	High	Low.
95–100	95–100	90–100	75–95	36–48	15–28	0.2–0.6	0.12–0.18	6.1–7.8	Moderate	High	Low.
95–100	95–100	90–100	70–90	32–40	14–24	0.2–0.6	0.14–0.18	7.4–7.8	Moderate	High	Low.
85–100	80–95	65–80	35–45	18–24	7–10	2.0–6.0	0.14–0.16	6.1–7.3	Low	Low	Low.
85–100	80–95	80–90	35–55	25–45	11–20	0.6–2.0	0.16–0.18	5.1–7.3	Moderate	Moderate	Moderate.
85–95	80–90	55–70	20–40	15–22	2–8	0.6–2.0	0.11–0.13	7.4–7.8	Low	Low	Low.
95–100	80–100	65–90	40–75	15–35	2–10	0.6–2.0	0.20–0.22	6.1–7.8	Low	High	Low.
95–100	80–95	65–85	40–75	25–40	8–20	0.6–2.0	0.15–0.19	6.1–7.8	Low	High	Low.
40–85	30–85	20–40	0–10		NP	6.0–20.0	0.02–0.04	7.4–8.4	Low	High	Low.
100	100	70–85	20–35		NP	6.0–20.0	0.07–0.09	5.6–7.3	Low	Low	Low.
100	100	70–85	20–40	<20	2–10	2.0–6.0	0.10–0.15	6.6–7.8	Low	Low	Moderate.
95–100	90–100	70–100	60–95	51–60	29–34	0.06–0.2	0.09–0.11	7.4–8.4	High	High	Low.
95–100	90–100	60–80	20–40	<20	2–10	2.0–6.0	0.09–0.14	5.6–7.3	Low	Low	Moderate.
95–100	95–100	85–100	70–95	51–60	29–34	0.06–0.2	0.08–0.10	7.4–7.8	High	High	Low.
100	100	70–95	40–60	18–29	2–8	0.6–2.0	0.16–0.18	6.1–7.3	Low	Low	Low.
100	100	90–100	60–80	14–36	5–18	0.6–2.0	0.16–0.20	6.1–7.8	Low	Low	Low.
100	100	75–90	40–80	<25	NP–4	0.6–2.0	0.14–0.18	7.4–7.8	Low	Low	Low.
100	100	90–100	70–90	25–40	5–9	0.6–2.0	0.22–0.24	6.6–7.8	Low	High	Low.
95–100	95–100	80–95	50–80	17–34	6–14	0.6–2.0	0.17–0.19	7.3–7.8	Low	High	Low.
95–100	90–100	40–70	25–40	20–30	2–8	0.6–2.0	0.11–0.13	7.4–7.8	Low	High	Low.
100	80–100	50–90	15–20		NP	6.0–20.0	0.08–0.10	5.6–6.5	Low	Low	Low.
100	80–100	60–85	5–25		NP	2.0–20.0	0.07–0.09	5.6–7.3	Low	Low	Low.
95–100	90–100	80–100	60–85	27–37	9–16	0.2–2.0	0.17–0.19	5.6–7.3	Moderate	Moderate	Moderate.
95–100	90–100	75–100	65–95	51–68	21–42	0.06–0.2	0.10–0.12	5.6–7.3	High	High	Moderate.
95–100	90–100	70–100	60–95	51–60	29–34	0.06–0.2	0.09–0.11	7.4–7.8	High	High	Low.
100	100	60–75	20–30		NP	6.0–20.0	0.10–0.12	5.6–7.3	Low	Low	Moderate.
100	100	60–75	15–25		NP	6.0–20.0	0.06–0.08	6.1–7.8	Low	Low	Moderate.
100	95–100	70–85	20–45	<20	NP–4	2.0–6.0	0.10–0.13	5.6–7.3	Low	Low	Moderate.
100	95–100	60–80	10–40	<20	NP–4	2.0–6.0	0.08–0.13	5.6–7.3	Low	Low	Moderate.
100	70–100	65–85	15–25		NP	6.0–20.0	0.06–0.08	7.4–7.8	Low	Low	Low.
75–100	65–95	60–90	25–40	<22	NP–10	2.0–6.0	0.13–0.18	5.6–7.3	Low	Moderate	Low.
80–100	65–95	35–65	15–40	<35	NP–16	2.0–6.0	0.10–0.17	5.6–7.3	Low	Moderate	Low.
40–95	30–70	20–55	0–10		NP	>20.0	0.02–0.06	7.4–7.8	Low	Moderate	Low.
100	100	65–80	25–45	12–29	NP–7	2.0–6.0	0.13–0.15	6.1–7.3	Low	Moderate	Low.
100	100	65–75	30–40	15–30	2–10	6.0–20.0	0.12–0.14	6.6–7.8	Low	Moderate	Low.
95–100	95–100	80–95	85–95	40–60	20–35	<0.06	0.10–0.17	7.4–8.4	High	High	Low.
100	100	60–70	15–25	<25	NP–7	2.0–6.0	0.13–0.15	6.1–7.3	Low	Moderate	Low.
95–100	95–100	60–70	20–35	15–30	2–10	2.0–6.0	0.12–0.14	6.1–7.3	Low	Moderate	Low.
95–100	85–100	85–95	80–95	40–60	20–35	0.06–0.2	0.06–0.10	7.4–7.8	High	High	Low.

year. The estimates are for soil material that has not been artificially drained. In general, the information in the table applies to a depth of 5 feet or less. Depth from the surface normally is given only for the major horizons. Other horizons are listed if they have engineering properties that differ significantly from those in adjacent horizons.

The estimated classification according to the textural classification of the U.S. Department of Agriculture and according to the AASHTO and Unified classification systems is given for each important layer. The figures showing the percentage of material passing through sieves Nos. 4, 10, 40, and 200 are rounded off to the nearest 5 percent. The percentage passing the No. 200 sieve approximate the combined amount of silt and clay in the soil.

Liquid limit and plasticity index pertain to the effect of water on the strength and consistence of soil material. The plastic limit is the moisture content at which the soil material changes from semisolid to plastic, and the liquid limit, from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

In the column "Permeability" are estimates of the rate at which water moves downward through undisturbed soil material. The estimates are based mainly on texture, structure, and consistence of the soils. The estimates do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most plants.

Reaction is the range in acidity or alkalinity of a soil, expressed in pH values. The pH value and equivalent verbal descriptions of reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume of the soil that results from a change in the moisture content, that is, the extent to which the soil shrinks when dry and swells when wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil.

Corrosion is the result of the potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil properties, such as drainage, texture, total acidity, and electrical conductivity of the soil material. The risk of corrosion on concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. A rating of *low* indicates a low probability of soil-induced corrosion damage. A rating of *high* indicates a high probability of damage so that protective measures for steel and more resistant concrete are needed to avoid or minimize damage.

Engineering interpretations

The estimated interpretations in tables 8 and 9 are based on the engineering properties of soils shown in table 7, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers (*2*) and soil scientists with the soils of Washtenaw County. In tables 8 and 9, ratings summarize the limitation or the suitability of the soils for all the listed purposes.

Limitations are expressed as *slight, moderate,* and *severe. Slight* means that soil properties are generally favorable for the rated use, or limitations and minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design (fig. 22). *Severe* indicates soil properties so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Soil suitability is expressed as *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in tables 8 and 9.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, and open ditches. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrop or big stones, and no flooding or a high water table.

Dwellings, as rated in table 8, are no more than three stories high and are supported by foundation footings placed in undisturbed soils. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, and content of stones and rocks.

Local roads and streets, as rated in table 8, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load supporting capacity and stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table, and susceptibility to flooding.

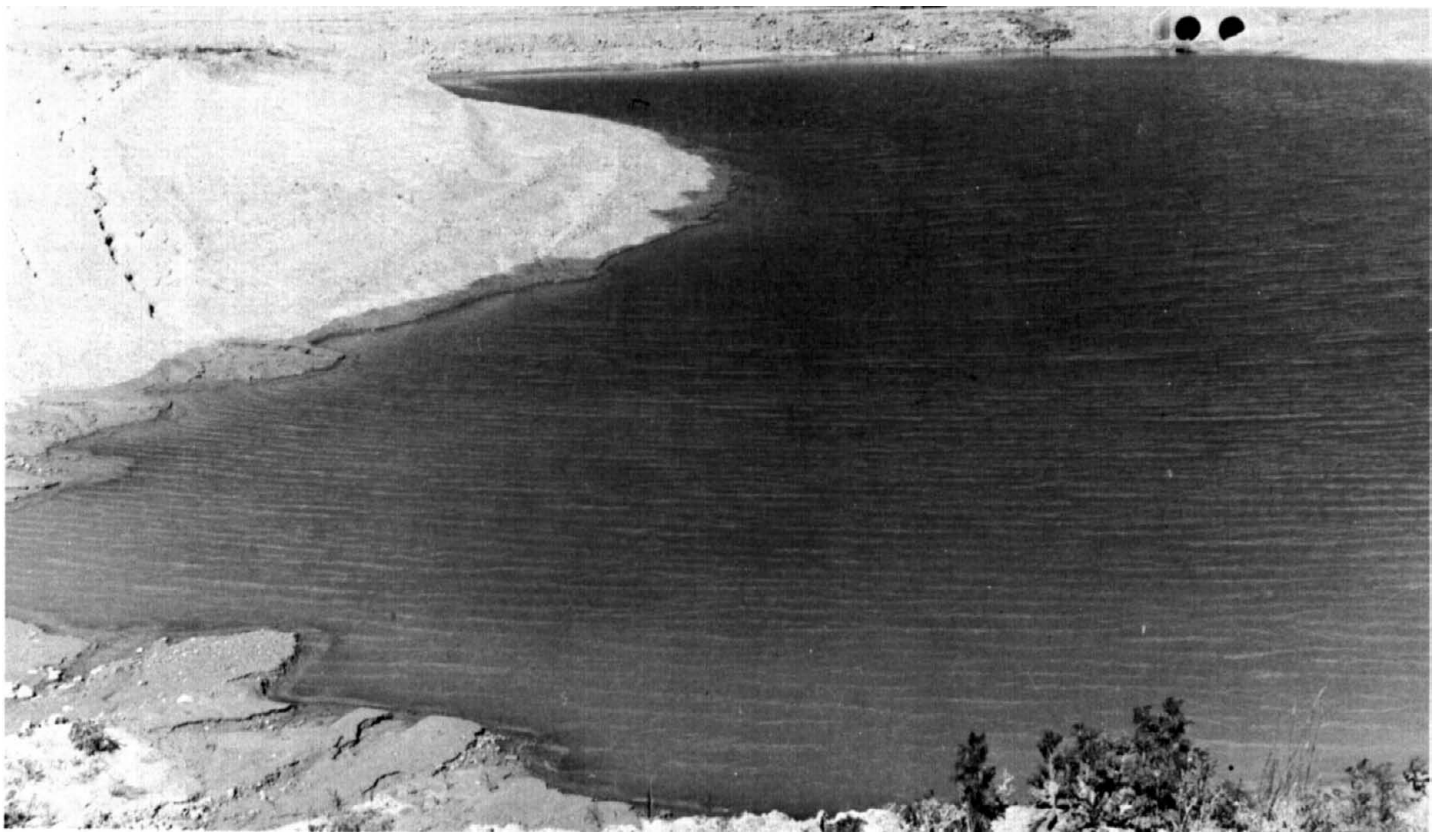

Figure 22.—Sediment-control basin built in Morley and Blount loams.

Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. It is assumed that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, and slope. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified Soil Classification and the content of stones, if any, that influence the ease of excavation and the compaction of the embankment material.

Trench type sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 8 apply only to a depth of about 6 feet. Limitation ratings of *slight* or *moderate*, therefore, may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but regardless, every site should be investigated before it is selected.

Area type landfill is a method of disposing of refuse by placing it in successive layers on the surface of the soil. The daily and final cover material generally must be imported. A final cover of soil material, at least 2 feet thick, is placed over the fill when it is completed.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage, and (2) the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the material. Neither do they indicate quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; natural fer-

TABLE 8.—*Construction sites and*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first column

Soil series and map symbols	Degree and kind of limitation for—			
	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings
Adrian: Ad	Severe: wet; floods; cutbanks cave; excess humus.	Severe: wet; floods; frost action; excess humus.	Severe: wet; floods	Severe: wet; floods; frost action; excess humus.
Blount:				
BbA	Severe: wet	Severe: wet; frost action.	Severe: wet	Severe: wet; frost action.
BbB	Severe: wet	Severe: wet; frost action.	Severe: wet	Severe: wet; frost action.
*Boyer:				
BnB	Severe: cutbanks cave.	Slight	Slight	Moderate: slope
BnC	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope
BnD, BnE, BoE For Kidder part of BoE, see KrD in Kidder series.	Severe: cutbanks cave; slope.	Severe: slope	Severe: slope	Severe: slope
BnF	Severe: cutbanks cave; slope.	Severe: slope	Severe: slope	Severe: slope
Brookston: Br	Severe: wet; floods	Severe: wet; floods; frost action.	Severe: wet; floods	Severe: wet; floods; frost action.
Cohoctah: Cc	Severe: wet; floods; cutbanks cave.	Severe: wet; floods; frost action.	Severe: wet; floods	Severe: wet; floods; frost action.
Colwood Mapped only with Lamson soils.	Severe: wet; floods; cutbanks cave.	Severe: wet; frost action; low strength; floods.	Severe: wet; floods; low strength.	Severe: wet; frost action; low strength; floods.
*Conover: CoB, CpA For Brookston part of CpA, see Brookston series.	Severe: wet	Severe: wet; frost action.	Severe: wet	Severe: wet; frost action.
*Dixboro: DoA For Kibbie part of DoA, see Kibbie series.	Severe: wet; cutbanks cave.	Severe: wet; frost action.	Severe: wet	Severe: wet; frost action.
Edwards: Ed	Severe: wet; excess humus; floods; cutbanks cave.	Severe: wet; floods; excess humus; low strength; frost action.	Severe: wet; floods; low strength.	Severe: wet; floods; excess humus; low strength; frost action.
Edwards variant: Ee	Severe: wet; floods; cutbanks.	Severe: wet; floods; low strength.	Severe: wet; floods; low strength.	Severe: wet; floods; low strength.
Fill land: Fd. No interpretations. Too variable.				
Fox:				
FoA, FoB	Severe: cutbanks cave.	Slight	Slight	Slight
FoC	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope
FoD, FoE	Severe: slope	Severe: slope	Severe: slope	Severe: slope

sanitary facilities

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the of the table. Some terms in this table are explained in the Glossary]

Degree and kind of limitation for—Continued					Suitability as a source of daily cover for landfill
Local roads and streets	Septic tank absorption fields	Sewage lagoons	Sanitary landfill (trench) [1]	Sanitary landfill (area)	
Severe: wet; floods; frost action; low strength; excess humus.	Severe: wet; floods.	Severe: wet; seepage.	Severe: wet; floods; seepage; excess humus.	Severe: wet; floods; seepage.	Poor: wet; excess humus; hard to pack.
Severe: frost action; shrink-swell.	Severe: wet; percs slowly.	Slight	Severe: wet	Moderate: wet	Fair: too clayey.
Severe: frost action; shrink-swell.	Severe: wet; percs slowly.	Moderate: slope	Severe: wet	Moderate: wet	Fair: too clayey.
Slight	Slight [2]	Severe: seepage	Severe: seepage	Severe: seepage	Fair: thin layer.
Moderate: slope	Moderate: slope [2]	Severe: seepage; slope.	Severe: seepage	Severe: seepage	Fair: thin layer.
Severe: slope	Severe: slope [2]	Severe: seepage; slope.	Severe: seepage	Severe: seepage; slope.	Poor: slope.
Severe: slope	Severe: slope [2]	Severe: seepage; slope.	Severe: seepage; slope.	Severe: seepage; slope.	Poor: slope.
Severe: wet; floods; frost action.	Severe: wet; floods; percs slowly.	Severe: wet	Severe: wet; floods.	Severe: wet; floods.	Poor: wet.
Severe: wet; floods; frost action.	Severe: wet; floods.	Severe: wet; floods; seepage.	Severe: wet; floods; seepage.	Severe: wet; floods; seepage.	Poor: wet.
Severe: wet; frost action; low strength; floods.	Severe: wet; floods.	Severe: wet	Severe: wet; floods.	Severe: wet; floods.	Poor: wet.
Severe: frost action.	Severe: wet; percs slowly.	Severe: wet	Severe: wet	Severe: wet	Good.
Severe: frost action.	Severe: wet	Severe: wet	Severe: wet	Severe: wet	Good.
Severe: wet; floods; frost action; excess humus; low strength.	Severe: wet; floods.	Severe: wet; seepage; excess humus; floods.	Severe: wet; seepage; floods; excess humus.	Severe: wet; seepage; floods.	Poor: wet; excess humus; seepage; hard to pack.
Severe: wet; floods; low strength.	Severe: wet; floods.	Severe: wet; seepage; excess humus.	Severe: wet; seepage; floods; excess humus.	Severe: wet; seepage; floods.	Poor: wet; excess humus; hard to pack.
Slight	Slight [2]	Severe: seepage	Severe: seepage	Slight	Fair: too clayey; area reclaim.
Moderate: slope	Moderate: slope [2]	Severe: seepage	Severe: seepage	Moderate: slope	Fair: area reclaim; slope.
Severe: slope	Severe: slope [2]	Severe: seepage	Severe: seepage	Severe: slope	Poor: slope.

TABLE 8.—*Construction sites and*

Soil series and map symbols	Degree and kind of limitation for—			
	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings
Fox variant:				
FpB	Severe: small stones.	Slight	Slight	Slight
FpC	Severe: small stones.	Moderate: slope	Moderate: slope	Severe: slope
FpD	Severe: small stones; slope.	Severe: slope	Severe: slope	Severe: slope
Gilford: Gf	Severe: wet; cutbanks cave; floods.	Severe: wet; frost action; floods.	Severe: wet; floods	Severe: wet; frost action; floods.
Granby: Gr	Severe: wet; cutbanks cave; floods.	Severe: wet; floods	Severe: wet; floods	Severe: wet; floods
Houghton: Hn	Severe: wet; floods; cutbanks cave; excess humus.	Severe: wet; frost action; low strength; floods; excess humus.	Severe: wet; floods; excess humus; low strength.	Severe: wet; frost action; floods; excess humus; low strength.
Hoytville: Ho	Severe: wet; too clayey; floods.	Severe: wet; frost action; shrink-swell; floods.	Severe: wet; shrink-swell; floods.	Severe: wet; floods; frost action; shrink-swell.
Kendallville:				
KeB	Slight	Moderate: frost action.	Slight	Moderate: slope; frost action.
KeC	Moderate: slope	Moderate: slope; frost action.	Moderate: slope	Severe: slope
Kibbie: KnA	Severe: wet; cutbanks cave.	Severe: wet; frost action; low strength.	Severe: wet; low strength.	Severe: wet; frost action; low strength.
Kidder:				
KrB	Moderate: small stones.	Moderate: frost action.	Slight	Moderate: slope; frost action.
KrC	Moderate: slope; small stones.	Moderate: frost action; slope.	Moderate: slope	Severe: slope
KrD	Severe: slope	Severe: slope	Severe: slope	Severe: slope
*Lamson: Ln For Colwood part of Ln, see Colwood series.	Severe: wet; floods; cutbanks cave.	Severe: wet; frost action; floods; low strength.	Severe: wet; floods; low strength.	Severe: wet; frost action; floods; low strength.
Macomb: MaA	Severe: wet	Severe: wet; frost action.	Severe: wet	Severe: wet; frost action.
Made land: Mb. No interpretations. Too variable.				
Matherton: MdA	Severe: wet; cutbanks cave.	Severe: frost action; wet.	Severe: wet	Severe: frost action; wet.
Metamora: MfA	Severe: wet	Severe: frost action; wet.	Severe: wet	Severe: frost action; wet.
Miami:				
MmB	Slight	Moderate: frost action.	Slight	Moderate: slope; frost action.
MmC	Moderate: slope	Moderate: slope; frost action.	Moderate: slope	Severe: slope

sanitary facilities—Continued

Degree and kind of limitation for—Continued					Suitability as a source of daily cover for landfill
Local roads and streets	Septic tank absorption fields	Sewage lagoons	Sanitary landfill (trench) [1]	Sanitary landfill (area)	
Slight	Slight [2]	Severe: seepage	Severe: seepage	Severe: seepage	Poor: seepage; small stones.
Moderate: slope	Moderate: slope [2]	Severe: seepage; slope.	Severe: seepage	Severe: seepage	Poor: seepage; small stones.
Severe: slope	Severe: slope [2]	Severe: seepage; slope.	Severe: seepage	Severe: seepage; slope.	Poor: seepage; small stones; slope.
Severe: wet; floods; frost action.	Severe: wet; floods. [2]	Severe: wet; seepage.	Severe: wet; seepage; floods.	Severe: wet; seepage; floods.	Poor: wet; seepage.
Severe: wet; floods.	Severe: wet; floods. [2]	Severe: wet; seepage.	Severe: wet; seepage; floods; too sandy.	Severe: wet; seepage; floods.	Poor: wet; too sandy; seepage.
Severe: wet; floods; frost action; excess humus; low strength.	Severe: wet; floods.	Severe: wet; seepage; excess humus.	Severe: wet; floods; seepage; excess humus.	Severe: wet; floods; seepage.	Poor: wet; excess humus; hard to pack; seepage.
Severe: wet; shrink-swell; low strength; frost action; floods.	Severe: wet; percs slowly; floods.	Slight	Severe: wet; too clayey; floods.	Severe: wet; floods.	Poor: wet; too clayey; hard to pack.
Moderate: frost action; shrink-swell.	Severe: percs slowly.	Moderate: slope	Slight	Slight	Good.
Moderate: frost action; shrink-swell; slope.	Severe: percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: slope.
Severe: frost action; low strength.	Severe: wet	Severe: wet	Severe: wet	Severe: wet	Good.
Moderate: frost action.	Slight	Moderate: seepage; slope.	Slight	Slight	Good.
Moderate: slope; frost action.	Moderate: slope	Severe: slope	Slight	Moderate: slope	Fair: slope.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
Severe: wet; frost action; low strength; floods.	Severe: wet; floods.	Severe: wet	Severe: wet; floods.	Severe: wet; floods.	Poor: wet.
Severe: frost action.	Severe: wet; percs slowly.	Moderate: slope	Severe: wet	Severe: wet	Fair: too clayey.
Severe: frost action.	Severe: wet	Severe: wet; seepage.	Severe: wet; seepage.	Severe: wet	Fair: thin layer.
Severe: frost action.	Severe: wet; percs slowly.	Severe: wet	Severe: wet	Severe: wet	Good.
Moderate: frost action.	Moderate: percs slowly.	Moderate: seepage	Slight	Slight	Good.
Moderate: slope; frost action; low strength.	Moderate: percs slowly; slope.	Severe: slope	Slight	Moderate: slope	Fair: slope.

TABLE 8.—*Construction sites and*

Soil series and map symbols	Degree and kind of limitation for—			
	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings
Miami—Continued:				
MmD, MmE	Severe: slope	Severe: slope	Severe: slope	Severe: slope
MmF	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Morley:				
MoB	Moderate: too clayey.	Moderate: shrink-swell; frost action.	Moderate: shrink-swell.	Moderate: shrink-swell; frost action.
MoC	Moderate: too clayey; slope.	Moderate: shrink-swell; frost action; slope.	Moderate: shrink-swell; slope.	Severe: slope
MoD, MoE	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Nappanee:				
NaA	Severe: wet; too clayey.	Severe: frost action; shrink-swell; wet.	Severe: wet; shrink-swell.	Severe: wet; shrink-swell; frost action.
NaB	Severe: wet; too clayey.	Severe: frost action; shrink-swell; wet.	Severe: wet; shrink-swell.	Severe: wet; shrink-swell; frost action.
Oakville:				
OaB	Severe: cutbanks cave.	Slight	Slight	Slight
OaC	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope
Oshtemo:				
OsB	Severe: cutbanks cave.	Moderate: frost action.	Slight	Moderate: frost action.
OsC	Severe: cutbanks cave.	Moderate: slope; frost action.	Moderate: slope	Severe: slope
*Owosso:				
OwB	Slight	Moderate: frost action.	Slight	Moderate: frost action; slope.
For Miami part of OwB, see MmB in Miami series.				
OwC	Moderate: slope	Moderate: slope; frost action.	Moderate: slope	Severe: slope
For Miami part of OwC, see MmC in Miami series.				
Palms: Pa	Severe: wet; floods; cutbanks cave; excess humus.	Severe: wet; floods; frost action; excess humus; low strength.	Severe: wet; floods	Severe: wet; floods; frost action; excess humus; low strength.
Pella: Pc	Severe: wet; cutbanks cave; floods.	Severe: wet; frost action; low strength; floods.	Severe: wet; low strength; floods.	Severe: wet; frost action; low strength.
Pewamo: Pe	Severe: wet; floods	Severe: wet; frost action; floods.	Severe: wet; floods	Severe: wet; floods; frost action.
Riddles:				
RdB	Slight	Moderate: frost action.	Slight	Moderate: slope; frost action.
RdC	Moderate: slope	Moderate: slope; frost action.	Moderate: slope	Severe: slope
Sebewa: Sb	Severe: wet; cutbanks cave; floods.	Severe: wet; frost action; floods.	Severe: wet; floods	Severe: wet; frost action; floods.

sanitary facilities—Continued

Degree and kind of limitation for—Continued					Suitability as a source of daily cover for landfill
Local roads and streets	Septic tank absorption fields	Sewage lagoons	Sanitary landfill (trench) [1]	Sanitary landfill (area)	
Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
Moderate: shrink-swell; frost action.	Severe: percs slowly.	Moderate: slope	Slight	Slight	Fair: too clayey; hard to pack.
Moderate: frost action; slope; shrink-swell.	Severe: percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: too clayey; hard to pack.
Severe: slope	Severe: percs slowly; slope.	Severe: slope	Moderate: slope	Severe: slope	Poor: slope; too clayey; hard to pack.
Severe: frost action; shrink-swell; low strength.	Severe: wet; percs slowly.	Slight	Severe: wet; too clayey.	Severe: wet	Poor: hard to pack; too clayey.
Severe: frost action; shrink-swell; low strength.	Severe: wet; percs slowly.	Moderate: slope	Severe: wet; too clayey.	Severe: wet	Poor: hard to pack; too clayey.
Slight	Slight [2]	Severe: seepage	Severe: too sandy; seepage.	Severe: seepage	Poor: too sandy; seepage; area reclaim.
Moderate: slope	Moderate: slope [2]	Severe: seepage; slope.	Severe: too sandy; seepage.	Severe: seepage	Poor: too sandy; seepage; area reclaim.
Moderate: frost action.	Slight [2]	Severe: seepage	Severe: seepage	Severe: seepage	Fair: area reclaim; seepage.
Moderate: frost action; slope.	Moderate: slope [2]	Severe: seepage; slope.	Severe: seepage	Severe: seepage	Fair: area reclaim; seepage.
Moderate: frost action; shrink-swell.	Severe: percs slowly.	Severe: seepage; slope.	Slight	Slight	Good.
Moderate: shrink-swell; frost action; slope.	Severe: percs slowly.	Severe: slope; seepage.	Slight	Moderate: slope	Good.
Severe: wet; low strength; floods; frost action; excess humus.	Severe: wet; floods.	Severe: wet; seepage.	Severe: wet; floods; seepage; excess humus.	Severe: wet; floods; seepage.	Poor: wet; excess humus; seepage; hard to pack.
Severe: wet; frost action; floods; low strength.	Severe: wet; floods.	Severe: wet	Severe: wet; floods.	Severe: wet; floods.	Poor: wet.
Severe: wet; frost action; floods.	Severe: wet; percs slowly; floods.	Severe: wet; floods.	Severe: wet; floods.	Severe: wet; floods.	Poor: wet; too clayey; hard to pack.
Moderate: frost action; shrink-swell.	Slight	Moderate: seepage; slope.	Slight	Slight	Good.
Moderate: shrink-swell; frost action; slope.	Moderate: slope	Severe: slope	Slight	Moderate: slope	Fair: slope.
Severe: wet; frost action; floods.	Severe: wet; floods. [3]	Severe: wet; seepage.	Severe: wet; floods; seepage.	Severe: wet; floods.	Poor: wet.

TABLE 8.—*Construction sites and*

Soil series and map symbols	Degree and kind of limitation for—			
	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings
Seward:				
SeB	Severe: too clayey; cutbanks cave.	Severe: low strength.	Severe: low strength.	Severe: low strength.
SeC	Severe: too clayey; cutbanks cave.	Severe: low strength.	Severe: low strength.	Severe: low strength; slope.
Seward variant: SfB	Severe: too clayey	Severe: shrink-swell; low strength.	Severe: shrink-swell; low strength.	Severe: shrink-swell; low strength.
Sisson:				
SnB	Moderate: cutbanks cave.	Moderate: low strength; frost action.	Moderate: low strength.	Moderate: frost action; low strength; slope.
SnC	Moderate: slope; cutbanks cave.	Moderate: slope; low strength; frost action.	Moderate: slope; low strength.	Severe: slope
Sloan: So	Severe: wet; floods; cutbanks cave.	Severe: wet; frost action; floods.	Severe: wet; floods	Severe: wet; frost action; floods.
*Spinks:				
SpB, SrB For Oshtemo part of SrB, see OsB in Oshtemo series.	Severe: cutbanks cave.	Slight	Slight	Slight
SpC	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope
SpD, SpE	Severe: slope; cutbanks cave.	Severe: slope	Severe: slope	Severe: slope
St. Clair:				
StB	Severe: too clayey	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
StC	Severe: too clayey	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope; shrink-swell.
StD, StE	Severe: too clayey; slope.	Severe: shrink-swell; slope.	Severe: shrink-swell; slope.	Severe: slope; shrink-swell.
Tedrow: TeA	Severe: wet; cutbanks cave.	Severe: wet	Severe: wet	Severe: wet
Thetford: ThA	Severe: wet; cutbanks cave.	Severe: wet	Severe: wet	Severe: wet
Wasepi: WaA	Severe: wet; cutbanks cave.	Severe: frost action; wet.	Severe: wet	Severe: wet; frost action.
Wauseon: Ws	Severe: wet; too clayey; floods.	Severe: wet; frost action; floods; shrink-swell.	Severe: wet; shrink-swell; floods.	Severe: wet; shrink-swell; floods; frost action.
Ypsi: YpA	Severe: wet; too clayey.	Severe: wet; frost action; shrink-swell.	Severe: wet; shrink-swell.	Severe: wet; shrink-swell; frost action.

[1] Onsite study is needed of the underlying strata, the water table, and the hazards of aquifer pollution and drainage into ground water in landfill deeper than 5 or 6 feet.

sanitary facilities—Continued

Degree and kind of limitation for—Continued					Suitability as a source of daily cover for landfill
Local roads and streets	Septic tank absorption fields	Sewage lagoons	Sanitary landfill (trench) [1]	Sanitary landfill (area)	
Severe: shrink-swell; low strength.	Severe: percs slowly.	Moderate: slope	Severe: too clayey; wet.	Slight	Fair: thin layer.
Severe: shrink-swell; low strength.	Severe: percs slowly.	Severe: slope	Severe: too clayey; wet.	Moderate: slope	Fair: thin layer.
Severe: shrink-swell; low strength.	Severe: percs slowly.	Moderate: slope	Severe: too clayey; wet.	Slight	Fair: thin layer.
Moderate: frost action; low strength.	Slight	Moderate: slope; seepage.	Slight	Slight	Good.
Moderate: frost action; low strength; slope.	Moderate: slope	Severe: slope	Slight	Moderate: slope	Fair: slope.
Severe: wet; frost action; floods.	Severe: wet; floods.	Severe: wet; floods.	Severe: wet; floods.	Severe: wet; floods.	Poor: wet.
Slight	Slight [2]	Severe: seepage	Severe: seepage; too sandy.	Severe: seepage	Poor: seepage; too sandy; area reclaim.
Moderate: slope	Moderate: slope [2]	Severe: seepage; slope.	Severe: seepage; too sandy.	Severe: seepage	Poor: seepage; too sandy; area reclaim.
Severe: slope	Severe: slope [2]	Severe: seepage; slope.	Severe: seepage; too sandy.	Severe: seepage; slope.	Poor: seepage; slope; too sandy; area reclaim.
Severe: low strength; shrink-swell.	Severe: percs slowly.	Moderate: slope	Severe: too clayey.	Slight	Poor: too clayey.
Severe: low strength; shrink-swell.	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Moderate: slope	Poor: too clayey.
Severe: slope; shrink-swell; low strength.	Severe: percs slowly; slope.	Severe: slope	Severe: too clayey.	Severe: slope	Poor: too clayey.
Moderate: wet; frost action.	Severe: wet [2]	Severe: wet; seepage.	Severe: wet; seepage; too sandy.	Severe: wet; seepage.	Fair: too sandy; seepage.
Moderate: wet; frost action.	Severe: wet [2]	Severe: wet; seepage.	Severe: wet; seepage; too sandy.	Severe: wet; seepage.	Fair: too sandy; seepage.
Severe: frost action.	Severe: wet [2]	Severe: wet; seepage.	Severe: wet; seepage.	Severe: wet; seepage.	Fair: thin layer.
Severe: wet; floods; frost action; shrink-swell.	Severe: wet; percs slowly; floods.	Slight	Severe: wet; too clayey; floods.	Severe: wet; floods.	Poor: wet.
Severe: shrink-swell; frost action.	Severe: wet; percs slowly.	Severe: seepage	Severe: wet; too clayey.	Severe: wet	Fair: thin layer.

[2] Possible contamination of ground water supply.

TABLE 9.—*Construction material*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first column

Soil series and map symbols	Suitability as source of—			
	Road fill	Sand	Gravel	Topsoil
Adrian: Ad	Poor: wet; excess humus; low strength.	Poor: excess fines	Poor: excess fines	Poor: wet
Blount:				
BbA	Poor: shrink-swell; frost action.	Unsuited	Unsuited	Fair: thin layer
BbB	Poor: shrink-swell; frost action.	Unsuited	Unsuited	Fair: thin layer
*Boyer:				
BnB	Good	Good	Good	Poor: too sandy
BnC	Good	Good	Good	Poor: too sandy
BnD, BnE, BoE For Kidder part of BoE, see KrD in Kidder series.	Fair: slope	Good	Good	Poor: too sandy; slope.
BnF	Poor: slope	Good	Good	Poor: too sandy; slope.
Brookston: Br	Poor: wet	Unsuited	Unsuited	Poor: wet
Cohoctah: Cc	Poor: wet; frost action.	Unsuited	Unsuited	Poor: wet
Colwood Mapped only in complex with Lamson soils.	Poor: wet	Unsuited	Unsuited	Poor: wet
*Conover: CoB, CpA For Brookston part of CpA, see Brookston series.	Poor: frost action	Unsuited	Unsuited	Fair: thin layer
*Dixboro: DoA For Kibbie part of DoA, see Kibbie series.	Poor: frost action	Poor: excess fines	Unsuited	Good
Edwards: Ed	Poor: frost action; excess humus; low strength; wet.	Unsuited	Unsuited	Poor: wet
Edwards variant: Ee	Poor: frost action; low strength; wet.	Unsuited	Unsuited	Poor: wet
Fill land: Fd. No interpretations. Too variable to rate.				
Fox:				
FoA, FoB	Good	Good	Good	Fair: thin layer
FoC	Good	Good	Good	Fair: thin layer; slope.
FoD, FoE	Fair: slope	Good	Good	Poor: slope

and water management

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the of the table. Some terms in this table are explained in the Glossary]

Soil features affecting—						
Pond reservoir area	Embankments, dikes, and levees	Excavated ponds, aquifer fed	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Seepage	Compressible; seepage; hard to pack; low strength.	Favorable	Wet; floods; cutbanks cave; poor outlets.	Wet; floods; seepage; fast intake, soil blowing.	Not needed	Not needed.
Favorable	Compressible; low strength.	Deep to water; slow refill.	Percs slowly; wet.	Wet; slow intake; percs slowly.	Not needed	Wet.
Favorable	Compressible; low strength.	Deep to water; slow refill.	Percs slowly; wet; complex slope.	Wet; slow intake; percs slowly; complex slope.	Wet; percs slowly; complex slope.	Wet; erodes easily.
Seepage	Seepage	No water	Not needed	Seepage; fast intake.	Complex slope; soil blowing.	Favorable.
Seepage; slope	Seepage	No water	Not needed	Seepage; fast intake; slope.	Complex slope; soil blowing.	Slope.
Seepage; slope	Seepage; slope	No water	Not needed	Seepage; fast intake; slope.	Complex slope; slope.	Slope.
Seepage; slope	Seepage; slope	No water	Not needed	Seepage; fast intake; slope.	Complex slope; slope.	Slope.
Favorable	Compressible; low strength; piping.	Favorable	Wet; floods	Wet; floods; percs slowly.	Not needed	Wet.
Seepage	Seepage; low strength; piping.	Favorable	Wet; floods; poor outlets.	Wet; floods	Not needed	Not needed.
Seepage	Low strength; piping; erodes easily.	Favorable	Wet; floods; cutbanks cave.	Wet; floods	Not needed	Wet; erodes easily.
Favorable	Hard to pack; low strength; piping.	Deep to water; slow refill.	Wet; complex slope.	Wet; percs slowly; complex slope.	Not needed	Wet.
Seepage	Low strength; hard to pack; piping.	Deep to water	Wet; cutbanks cave.	Wet	Not needed	Wet; erodes easily.
Seepage	Compressible; hard to pack; low strength.	Favorable	Wet; floods; cutbanks cave; poor outlets.	Wet; floods; seepage; soil blowing.	Not needed	Not needed.
Seepage	Compressible; hard to pack; low strength.	Favorable	Wet; floods; cutbanks cave; poor outlets.	Wet; floods; soil blowing; excess lime.	Not needed	Not needed.
Seepage	Seepage	No water	Not needed	Favorable	Favorable	Favorable.
Seepage; slope	Seepage	No water	Not needed	Complex slope; slope.	Complex slope; slope.	Slope.
Seepage; slope	Seepage	No water	Not needed	Complex slope; slope.	Complex slope; slope.	Slope.

TABLE 9.—*Construction material*

Soil series and map symbols	Suitability as source of—			
	Road fill	Sand	Gravel	Topsoil
Fox variant:				
FpB	Good	Fair	Good	Poor: small stones
FpC	Good	Fair	Good	Poor: small stones
FpD	Fair: slope	Fair	Good	Poor: small stones; slope.
Gilford: Gf	Poor: wet	Fair: excess fines	Fair: excess fines	Poor: wet
Granby: Gr	Poor: wet	Good	Unsuited	Poor: wet; too sandy.
Houghton: Hn	Poor: wet; frost action; low strength.	Unsuited	Unsuited	Poor: wet
Hoytville: Ho	Poor: wet; shrink-swell; low strength.	Unsuited	Unsuited	Poor: wet
Kendallville:				
KeB	Fair: frost action; low strength.	Unsuited	Unsuited	Fair: thin layer
KeC	Fair: frost action; low layer.	Unsuited	Unsuited	Fair: thin layer
Kibbie: KnA	Poor: frost action	Unsuited	Unsuited	Good
Kidder:				
KrB	Fair: frost action	Poor: excess fines	Poor: excess fines	Fair: thin layer
KrC	Fair: frost action	Poor: excess fines	Poor: excess fines	Fair: thin layer; slope.
KrD	Fair: frost action; slope.	Poor: excess fines	Poor: excess fines	Poor: slope
*Lamson: Ln For Colwood part of Ln, see Colwood series.	Poor: wet	Poor: excess fines	Unsuited	Poor: wet
Macomb: MaA	Fair: wet; frost action.	Unsuited	Unsuited	Fair: thin layer
Made land: Mb. No interpretations. Too variable.				
Matherton: MdA	Poor: frost action	Good	Good	Fair: thin layer
Metamora: MfA	Poor: frost action	Unsuited	Unsuited	Good
Miami:				
MmB	Fair: frost action; low strength.	Unsuited	Unsuited	Fair: thin layer
MmC	Fair: frost action; low strength.	Unsuited	Unsuited	Fair: thin layer; slope.

and water management—Continued

Soil features affecting—						
Pond reservoir area	Embankments, dikes, and levees	Excavated ponds, aquifer fed	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Seepage	Seepage	No water	Not needed	Complex slope	Complex slope	Favorable.
Seepage; slope	Seepage	No water	Not needed	Complex slope; slope.	Complex slope; slope.	Slope.
Seepage; slope	Seepage	No water	Not needed	Complex slope; slope.	Complex slope; slope.	Slope.
Seepage	Seepage	Favorable	Wet; floods; cutbanks cave.	Wet; floods; seepage.	Not needed	Not needed.
Seepage	Seepage; piping; erodes easily.	Favorable	Wet; floods; cutbanks cave.	Wet; floods; seepage; fast intake; soil blowing.	Not needed	Not needed.
Seepage	Low strength; seepage; unstable fill.	Favorable	Wet; floods; cutbanks cave; poor outlets.	Wet; floods; seepage; fast intake; soil blowing.	Not needed	Not needed.
Favorable	Compressible; hard to pack; low strength.	Slow refill	Percs slowly; wet; floods.	Wet; floods; slow intake; percs slowly.	Not needed	Wet; percs slowly.
Favorable	Low strength	No water	Not needed	Complex slope; erodes easily.	Complex slope; erodes easily.	Favorable.
Slope	Low strength	No water	Not needed	Complex slope; erodes easily; slope.	Complex slope; erodes easily; slope.	Slope.
Seepage	Erodes easily; unstable fill; piping.	Deep to water	Wet; cutbanks cave.	Wet	Not needed	Erodes easily.
Seepage	Seepage; piping	No water	Not needed	Complex slope; erodes easily.	Complex slope; erodes easily.	Favorable.
Seepage; slope	Seepage; piping	No water	Not needed	Complex slope; erodes easily; slope.	Complex slope; erodes easily; slope.	Slope.
Seepage; slope	Seepage; piping	No water	Not needed	Complex slope; erodes easily; slope.	Complex slope; erodes easily; slope.	Slope.
Seepage	Seepage; low strength; piping.	Favorable	Wet; floods; cutbanks cave.	Wet; floods	Not needed	Wet; erodes easily.
Favorable	Favorable	Favorable	Wet	Wet; percs slowly.	Not needed	Wet.
Favorable	Seepage	Favorable	Wet; cutbanks cave.	Favorable	Not needed	Favorable.
Favorable	Compressible; piping.	Deep to water; slow refill.	Wet	Wet; fast intake.	Not needed	Favorable.
Seepage	Compressible; low strength; piping.	No water	Not needed	Complex slope; erodes easily.	Complex slope; erodes easily.	Favorable.
Seepage; slope	Compressible; low strength; piping.	No water	Not needed	Complex slope; erodes easily; slope.	Complex slope; erodes easily; slope.	Slope.

TABLE 9.—*Construction material*

Soil series and map symbols	Suitability as source of—			
	Road fill	Sand	Gravel	Topsoil
Miami—Continued:				
MmD, MmE	Fair: frost action; low strength.	Unsuited	Unsuited	Poor: slope
MmF	Poor: slope	Unsuited	Unsuited	Poor: slope
Morley:				
MoB	Poor: shrink-swell; frost action; too clayey.	Unsuited	Unsuited	Fair: thin layer
MoC	Poor: shrink-swell; frost action; too clayey.	Unsuited	Unsuited	Fair: thin layer; slope.
MoD, MoE	Poor: shrink-swell; slope; frost action; too clayey.	Unsuited	Unsuited	Poor: slope
Nappanee:				
NaA	Poor: frost action; low strength; shrink-swell.	Unsuited	Unsuited	Fair: thin layer; too clayey.
NaB	Poor: frost action; low strength; shrink-swell.	Unsuited	Unsuited	Fair: thin layer; too clayey.
Oakville:				
OaB	Good	Good	Unsuited	Poor: too sandy
OaC	Good	Good	Unsuited	Poor: too sandy
Oshtemo:				
OsB	Good	Good	Fair	Poor: too sandy
OsC	Good	Good	Fair	Poor: too sandy
*Owosso:				
OwB	Fair: frost action; low strength.	Unsuited	Unsuited	Good
For Miami part of OwB, see MmB in Miami series.				
OwC	Fair: frost action; low strength.	Unsuited	Unsuited	Fair: slope
For Miami part of OwC, see MmC in Miami series.				
Palms: Pa	Poor: wet; low strength; excess humus; frost action.	Unsuited	Unsuited	Poor: wet
Pella: Pc	Poor: wet; frost action; low strength.	Unsuited	Unsuited	Poor: wet
Pewamo: Pe	Poor: wet; frost action.	Unsuited	Unsuited	Poor: wet

and water management—Continued

Soil features affecting—						
Pond reservoir area	Embankments, dikes, and levees	Excavated ponds, aquifer fed	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Seepage; slope	Compressible; low strength; piping.	No water	Not needed	Complex slope; erodes easily; slope.	Complex slope; erodes easily; slope.	Slope.
Seepage; slope	Compressible; low strength; piping.	No water	Not needed	Complex slope; erodes easily; slope.	Complex slope; erodes easily; slope.	Slope.
Favorable	Favorable	Deep to water; slow refill.	Not needed	Complex slope; erodes easily; slow intake.	Complex slope; erodes easily.	Erodes easily.
Slope	Favorable	No water	Not needed	Complex slope; erodes easily; slope; slow intake.	Complex slope; erodes easily; slope.	Slope; erodes easily.
Slope	Favorable	No water	Not needed	Complex slope; erodes easily; slope; slow intake.	Complex slope; erodes easily; slope.	Slope; erodes easily.
Favorable	Compressible; hard to pack; low strength; shrink-swell.	Deep to water; slow refill.	Percs slowly; wet.	Wet; slow intake; percs slowly.	Wet; percs slowly.	Wet; percs slowly.
Favorable	Compressible; hard to pack; low strength; shrink-swell.	Deep to water; slow refill.	Percs slowly; complex slope.	Wet; slow intake; percs slowly; complex slope.	Wet; complex slope; percs slowly.	Wet; percs slowly; erodes easily.
Seepage	Seepage; erodes easily; piping.	No water	Not needed	Seepage; fast intake; soil blowing.	Complex slope; too sandy; soil blowing; droughty.	Droughty; too sandy.
Seepage; slope	Seepage; erodes easily; piping.	No water	Not needed	Seepage; fast intake; soil blowing; slope.	Complex slope; slope; too sandy; soil blowing; droughty.	Droughty; slope.
Seepage	Seepage	No water	Not needed	Seepage; fast intake.	Complex slope	Favorable.
Seepage; slope	Seepage	No water	Not needed	Seepage; fast intake; slope.	Complex slope; slope.	Slope.
Seepage	Piping	No water	Not needed	Complex slope; erodes easily.	Complex slope; erodes easily.	Erodes easily.
Seepage; slope	Piping	No water	Not needed	Complex slope; erodes easily; slope.	Complex slope; erodes easily; slope.	Erodes easily; slope.
Seepage	Compressible; hard to pack; low strength.	Favorable	Wet; floods; poor outlets; cutbanks cave.	Wet; floods; seepage; fast intake; soil blowing.	Not needed	Not needed.
Seepage	Low strength; piping; erodes easily.	Favorable	Wet; floods; cutbanks cave.	Wet; floods	Not needed	Wet.
Favorable	Favorable	Favorable	Wet; floods; percs slowly.	Wet; floods; slow intake; percs slowly.	Not needed	Wet; percs slowly.

TABLE 9.—*Construction material*

Soil series and map symbols	Suitability as source of—			
	Road fill	Sand	Gravel	Topsoil
Riddles:				
RdB	Fair: frost action	Poor: excess fines	Poor: excess fines	Fair: thin layer
RdC	Fair: frost action	Poor: excess fines	Poor: excess fines	Fair: thin layer; slope.
Sebewa: Sb	Poor: wet	Good	Good	Poor: wet
Seward:				
SeB	Poor: shrink-swell; low strength.	Poor: excess fines	Unsuited	Poor: too sandy
SeC	Poor: shrink-swell; low strength.	Poor: excess fines	Unsuited	Poor: too sandy
Seward variant: SfB	Poor: shrink-swell	Unsuited	Unsuited	Fair: thin layer
Sisson:				
SnB	Fair: frost action; low strength.	Unsuited	Unsuited	Good
SnC	Fair: frost action; low strength.	Unsuited	Unsuited	Good
Sloan: So	Poor: wet; frost action.	Unsuited	Unsuited	Poor: wet
*Spinks:				
SpB, SrB For Oshtemo part of SrB, see OsB in Oshtemo series.	Good	Good	Unsuited	Poor: too sandy
SpC	Good	Good	Unsuited	Poor: too sandy
SpD, SpE	Fair: slope	Good	Unsuited	Poor: too sandy
St. Clair:				
StB	Poor: shrink-swell; low strength.	Unsuited	Unsuited	Fair: thin layer; too clayey.
StC	Poor: shrink-swell; low strength.	Unsuited	Unsuited	Fair: thin layer; too clayey; slope.
StD, StE	Poor: shrink-swell; low strength.	Unsuited	Unsuited	Fair: thin layer; too clayey; slope.
Tedrow: TeA	Fair: wet; area reclaim.	Fair: excess fines	Unsuited	Poor: too sandy

and water management—Continued

Soil features affecting—						
Pond reservoir area	Embankments, dikes, and levees	Excavated ponds, aquifer fed	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Seepage	Seepage; piping	No water	Not needed	Complex slope; erodes easily.	Complex slope; erodes easily.	Favorable.
Seepage; slope	Seepage; piping	No water	Not needed	Complex slope; erodes easily; slope.	Complex slope; erodes easily; slope.	Slope.
Seepage	Seepage	Favorable	Wet; floods; cutbanks cave.	Wet; floods	Not needed	Wet.
Favorable	Compressible; shrink-swell; hard to pack; low strength.	Deep to water; slow refill.	Not needed	Fast intake	Complex slope; soil blowing.	Erodes easily.
Slope	Compressible; shrink-swell; hard to pack; low strength.	No water	Not needed	Fast intake; slope.	Complex slope; soil blowing; slope.	Erodes easily; slope.
Favorable	Compressible; shrink-swell; hard to pack; low strength.	Deep to water; slow refill.	Not needed	Fast intake; complex slope.	Complex slope	Erodes easily.
Seepage	Low strength; piping; erodes easily.	No water	Not needed	Erodes easily	Complex slope; erodes easily.	Erodes easily.
Seepage; slope	Low strength; piping; erodes easily.	No water	Not needed	Erodes easily; slope.	Complex slope; erodes easily; slope.	Erodes easily; slope.
Favorable	Piping; low strength.	Favorable	Wet; floods; poor outlets.	Wet; floods	Not needed	Not needed.
Seepage	Seepage; piping	No water	Not needed	Seepage; fast intake; soil blowing; droughty.	Too sandy; soil blowing; droughty; complex slope.	Droughty.
Seepage; slope	Seepage; piping	No water	Not needed	Seepage; fast intake; slope; soil blowing; droughty.	Too sandy; soil blowing; droughty; complex slope; slope.	Droughty; slope.
Seepage; slope	Seepage; piping	No water	Not needed	Seepage; fast intake; slope; soil blowing; droughty.	Too sandy; soil blowing; droughty; complex slope; slope.	Droughty; slope.
Favorable	Shrink-swell; hard to pack; compressible; low strength.	Deep to water; slow refill.	Not needed	Percs slowly; slow intake; complex slope; erodes easily.	Complex slope; percs slowly; erodes easily.	Percs slowly; erodes easily.
Slope	Shrink-swell; hard to pack; compressible; low strength.	No water	Not needed	Percs slowly; slow intake; complex slope; erodes easily; slope.	Complex slope; percs slowly; erodes easily; slope.	Percs slowly; erodes easily; slope.
Slope	Shrink-swell; hard to pack; compressible; low strength.	No water	Not needed	Wet; seepage; fast intake; soil blowing; droughty.	Not needed	Droughty.
Seepage	Seepage; piping; erodes easily.	Deep to water	Wet; cutbanks cave.	Wet; seepage; fast intake; droughty.	Not needed	Droughty.

TABLE 9.—*Construction material*

Soil series and map symbols	Suitability as source of—			
	Road fill	Sand	Gravel	Topsoil
Thetford: ThA	Fair: wet	Fair: excess fines	Unsuited	Poor: too sandy
Wasepi: WaA	Poor: frost action	Good	Fair to good	Fair: thin layer
Wauseon: Ws	Poor: wet; shrink-swell.	Unsuited	Unsuited	Poor: wet
Ypsi: YpA	Poor: shrink-swell	Unsuited	Unsuited	Good

tility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability. Also considered in the ratings is damage that will result at the area from which topsoil is taken.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to permeability and the depth to permeable material.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Stones or organic materials in a soil are among factors that are unfavorable.

Drainage of crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope, stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion or soil blowing; soil texture; content of stones; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage or depth to water table or bedrock.

Terraces and diversions are embankments or ridges constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

The suitability of grassed waterways depends on soil features that affect the construction and maintenance of the waterways and the growth of plants in them. Important features are fertility, available water capacity, rate of surface runoff, and susceptibility to erosion. Establishment of a good, dense sod that is resistant to erosion is needed for well-constructed waterways.

Formation and Classification of Soils

This part of the survey tells how the factors of soil formation have affected the formation of soils in Washtenaw County. It also explains the system of soil classification (*7*) and classifies the soils according to that system.

Factors of Soil Formation

Soil forms through the interaction of five major factors: the physical, chemical, and mineral composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land, including the depth to the water table; and the length of time the processes of soil formation have acted on the parent material.

Climate and plant and animal life are the active forces in soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of the parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be a long or short time, but some time is required for differentiation of soil horizons. Generally, a long time is required for the formation of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generaliza-

and water management—Continued

Soil features affecting—						
Pond reservoir area	Embankments, dikes, and levees	Excavated ponds, aquifer fed	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Seepage	Seepage; piping	Deep to water	Wet; cutbanks cave.	Wet; seepage	Not needed	Droughty.
Seepage	Seepage; piping	Deep to water	Wet; cutbanks cave.	Wet; floods; percs slowly.	Not needed	Wet.
Favorable	Compressible; low strength; shrink-swell; hard to pack.	Favorable	Wet; floods; percs slowly.	Wet; percs slowly.	Not needed	Droughty.
Favorable	Compressible; low strength; shrink-swell; hard to pack.	Deep to water	Wet; percs slowly.	Wetness; percs slowly.	Not needed	Droughty.

tions can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

Parent material

Parent material is the unconsolidated mass from which a soil forms. The parent materials of the soils of Washtenaw County were deposited by glaciers or by melt water from the glaciers. Some of these materials are reworked and redeposited by subsequent actions of water and wind. These glaciers covered the county from about 10,000 to 12,000 years ago. Parent material determines the limits of the chemical and mineralogical composition of the soil. Although parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Washtenaw County were deposited as glacial till, outwash deposits, lacustrine deposits, alluvium, and organic material.

Glacial till is material laid down directly by glaciers with a minimum of water action. It consists of particles of different sizes that are mixed together. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water washing. The glacial till in Washtenaw County is calcareous. Its texture is sandy loam, loam, silty clay loam, clay loam, silty clay, or clay. Morley soils, for example, formed in glacial till. They typically are moderately fine textured and have well-developed structure.

Outwash material is deposited by running water from melting glaciers. The size of the particles that make up outwash material varies according to the speed of the stream of water that carried them. When the water slows down, the coarser particles are deposited. Finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally consist of layers of particles of similar size, such as sandy loam, sand, gravel, and other coarse particles. The Boyer soils, for example, formed in deposits of outwash material on Washtenaw County.

Lacustrine material is deposited from still, or ponded, glacial melt water. Because the coarser fragments drop out of moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remain to settle out in still water. In Washtenaw County, soils formed in lacustrine deposits are typically medium textured and moderately fine textured. Kibbie soils, for example, formed in lacustrine materials.

Alluvium material is deposited by floodwaters of present streams in recent time. This material ranges in texture, depending on the speed of the water from which it was deposited. The alluvium deposited along a swift stream like the Huron River is coarser textured than that deposited along a slow, sluggish stream like Mill Creek. Examples of alluvial soil are the Cohoctah and Sloan soils.

Organic material is made up of deposits of plant remains. After the glaciers withdrew from the area, water was left standing in depressions in outwash plains, lake plains, and till plains. Grasses and sedges growing around the edges of these lakes died, and their remains fell to the bottom. Because of wetness of the areas, the plant remains did not decompose but remained around the edge of the lake. Later water-tolerant trees grew on the areas. As these trees died, their residues became a part of the organic accumulation. Consequently, the lakes were eventually filled with organic material and developed into areas of muck. Houghton soils formed in organic material.

Plant and animal life

Green plants have been the principal organisms influencing the soils in Washtenaw County, but bacteria, fungi, earthworms, and the activities of man have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kinds of plants that grew on the soil. The remains of these plants accumulate on the surface, decay, and eventually become organic matter. Roots of the plants provide channels for downward

movement of water through the soil and also add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The vegetation in Washtenaw County was mainly deciduous forest. Differences in natural soil drainage and minor changes in parent material affected the composition of the forest species.

In general, the well-drained upland soils, such as the Miami, Morley, and Fox soils, were mainly covered with sugar maple and hickory. The Oakville soils were covered with scrub oak. The wet soils were covered mainly by soft maple, elm, and ash. The Brookston and Sebewa soils formed under wet conditions, and they contain considerable organic matter.

Climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil, and it determines the amount of water available for weathering of minerals and the transporting of soil material. Climate, through its influence on temperatures in the soil, determines the rate of chemical reaction that occurs in the soil. These influences are important, but affect large areas rather than a relatively small area, such as a county.

The climate in Washtenaw County is cool and humid. This is presumably similar to that which existed when the soils formed. The soils in Washtenaw County differ from soils formed in a dry, warm climate or from those formed in a hot, moist climate. Climate is uniform throughout the county, although its effect is modified locally by the proximity to large lakes. Only minor differences in the soils of Washtenaw County are the results of the differences in climate.

Relief

Relief, or topography, has a marked influence on the soils of Washtenaw County, through its influence on natural drainage, erosion, plant cover, and soil temperature. In Washtenaw County slopes range from 0 to 40 percent. Natural soil drainage ranges from well drained on the ridgetops to very poorly drained in the depressions.

Relief influences the formation of soils by affecting runoff and drainage; drainage in turn, through its affect on aeration of the soil, determines the color of the soil. Runoff is greatest on the steeper slopes. In low areas, water is temporarily ponded. Water and air move freely through soils that are well drained but slowly through soils that are very poorly drained. In soils that are well aerated, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized, and in poorly aerated soils the color is dull gray and mottled. Miami soils are examples of well-drained, well aerated soils. Brookston soils are examples of poorly aerated, very poorly drained soils. All formed in similar parent material.

Time

Time, usually a long time, is required for the formation of distinct horizons from the parent material. The differences in length of time that the parent material has been in place are commonly reflected in the degree of development of the soil profile. Some soils develop rapidly, others slowly.

The soils in Washtenaw County range from young to mature. The glacial deposits from which many of the soils in Washtenaw County formed have been exposed to soil-forming factors for a long enough time to allow the formation of distinct horizons. Some soils forming in recent alluvial sediments have not been in place long enough for the formation of distinct horizons.

The Sloan soil is an example of a young soil formed in alluvial material. In Brookston and Pewamo soils the effect of more time on leaching of lime from the soil is evident.

Genesis and Morphology

The processes, or soil-forming factors, responsible for the development of the soil horizons from the unconsolidated parent material are referred to as soil genesis. The physical, chemical, and biological properties of the various soil horizons are termed soil morphology.

Several processes were involved in the development of soil horizons in the soils of Washtenaw County: (1) accumulation of organic matter, (2) leaching of lime (calcium carbonates) and other bases, (3) reduction and transfer of iron, and (4) formation and translocation of silicate clay minerals. In most soils of Washtenaw County more than one of these processes has been active in the development of the horizons.

Organic matter accumulated at the surface to form an A1 horizon. The A1 horizon is mixed into a plow layer (Ap) when the soil is plowed. In the soils of Washtenaw County, the surface layer ranges from high to low in organic matter content. Sebewa soils, for example, have a high organic-matter content in the surface layer, and the Fox soils a low organic-matter content.

Leaching of carbonates and other bases occurred in most of the soils. Soil scientists generally agree that leaching of bases in soils usually precedes the translocation of silicate clay minerals. Many of the soils are moderately to strongly leached. For example, Riddles soils are leached of carbonates to a depth of 50 inches, whereas Lamson soils are leached to a depth of only 32 inches. Differences in the depth of leaching is a result of "time" as a soil-forming factor.

The reduction and transfer of iron, a process called gleying, is evident in the somewhat poorly drained, poorly drained, and very poorly drained soils. The gray color in the subsoil horizons indicates the reduction and loss of iron. Pewamo soils are an example of gleying and the reduction processes.

In some soils the translocation of clay minerals has contributed to horizon development. The eluviated, or leached, A2 horizon above the illuviated B horizon has a platy structure, is lower in content of clay, and typically is lighter in color. The B horizon typically has an accumulation of clay (clay films) in pores and on ped surfaces. These soils were probably leached of carbonates and soluble salts to a considerable extent before translocation of silicate clay took place. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation

TABLE 10.—*Classification of the soils*

Soil series	Family	Subgroup	Order
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic	Terric Medisaprists	Histosols.
Blount	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Boyer	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Brookston	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.
Cohoctah [1]	Coarse-loamy, mixed, mesic	Fluvaquentic Haplaquolls	Mollisols.
Colwood	Fine-loamy, mixed, mesic	Typic Haplaquolls	Mollisols.
Conover	Fine-loamy, mixed, mesic	Udollic Ochraqualfs	Alfisols.
Dixboro	Coarse-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Edwards	Marly, euic, mesic	Limnic Medisaprists	Histosols.
Edwards variant [2]	Marly, euic, mesic	Histic Limaquents	Entisols.
Fill land	Loamy and sandy	Udorthents	Entisols.
Fox [3]	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Hapludalfs	Alfisols.
Fox variant	Loamy-skeletal, mixed, mesic	Typic Hapludalfs	Alfisols.
Gilford	Coarse-loamy, mixed, mesic	Typic Haplaquolls	Mollisols.
Granby	Sandy, mixed, mesic	Typic Haplaquolls	Mollisols.
Houghton	Euic, mesic	Typic Medisaprists	Histosols.
Hoytville	Fine, illitic, mesic	Mollic Ochraqualfs	Alfisols.
Kendallville	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Kibbie	Fine-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Kidder	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Lamson	Coarse-loamy, mixed, non-acid, mesic	Aeric Haplaquepts	Inceptisols.
Macomb	Fine-loamy, mixed, mesic	Udollic Ochraqualfs	Alfisols.
Made land	Not classified.		
Matherton	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Udollic Ochraqualfs	Alfisols.
Metamora [4]	Fine-loamy, mixed, mesic	Udollic Ochraqualfs	Alfisols.
Miami	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Morley	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Nappanee	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Oakville	Mixed, mesic	Typic Udipsamments	Entisols.
Oshtemo	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Owosso	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Palms	Loamy, mixed, euic, mesic	Terric Medisaprists	Histosols.
Pella	Fine-silty, mixed, mesic	Typic Haplaquolls	Mollisols.
Pewamo	Fine, mixed, mesic	Typic Argiaquolls	Mollisols.
Riddles	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Argiaquolls	Mollisols.
Seward	Loamy, mixed, mesic	Arenic Hapludalfs	Alfisols.
Seward variant	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Sisson	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Sloan [1]	Fine-loamy, mixed, mesic	Fluvaquentic Haplaquolls	Mollisols.
Spinks	Sandy, mixed, mesic	Psammentic Hapludalfs	Alfisols.
St. Clair	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Tedrow	Mixed, mesic	Aquic Udipsamments	Entisols.
Thetford	Sandy, mixed, mesic	Psammaquentic Hapludalfs	Alfisols.
Wasepi	Coarse-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Wauseon	Coarse-loamy over clayey, mixed, mesic	Typic Haplaquolls	Mollisols.
Ypsi	Coarse-loamy over clayey, mixed, mesic	Udollic Ochraqualfs	Alfisols.

[1] These soils are taxadjuncts to the series because they are calcareous throughout the 10- to 20-inch control section.
[2] Tentative classification. Not in system at present.
[3] These soils are taxadjuncts to the Fox series because they typically are more than 45 percent fine and coarse sand, and they contain more coarse fragments than typical Fox soils.
[4] These soils are taxadjuncts to the Metamora series because they lack dominant gray colors in the upper part of the B horizon.

in soils. The Morley soil is an example of a soil having translocated silicate clays in the form of clay films accumulated in the B horizon.

Classification of the Soils

Soils are classified so that their significant characteristics can be more easily remembered. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to small specific areas or large tracts of land.

The Comprehensive Classification System, the system currently used, was adopted by the National Cooperative Soil Survey in 1965 (*4*). This system is under continual study. Therefore, readers interested in new developments and revision of this soil classification system should search the latest available literature.

The current system of classification has six categories. Beginning with the broadest, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped together. In table 10 the soils are classified according to the current system.

Order. Ten soil orders are recognized. They are

Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings to soils. The two exceptions to this are the Entisols and Histosols, which may occur in many different climates. The soil orders in Washtenaw County are Entisols, Inceptisols, Alfisols, Mollisols, and Histosols.

Entisols are recent; they lack genetic horizons or have only the beginnings of such horizons. Oakville soils are examples of Entisols in Washtenaw County.

Inceptisols most often are on young but not recent land surfaces. In Washtenaw County, Lamson soils are examples of the Inceptisol order.

Alfisols have a clay enriched B horizon that is high in base saturation. Miami, Morley, and Fox soils represent the Alfisols in Washtenaw County.

Mollisols have a thick, dark-colored surface. Brookston soils are examples of the Mollisol order in the county.

Histosols formed in organic material. They commonly include mucks, peats, organic soils, and bogs. Houghton soils are examples of the Histosols in Washtenaw County.

Suborder. Each order is divided into suborders, primarily on the basis of those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborder narrows the broad climatic range permitted in the order. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. Examples of the suborder category are Psamments and Udalfs.

Great Groups. Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans that interfere with the growth of roots or movement of water. The features used are some properties of clays, soil temperature, and major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium).

Subgroups. Each great group is divided into subgroups, one representing the central concept of the group and others called intergrades and extragrades. An intergrade subgroup has properties of the group and also one or more properties of another great group, suborder, or order. An extragrade subgroup has properties of the group and characteristics that are not diagnostic of another great group, suborder, or order. Examples of subgroup names are Typic Hapludalfs for central concept, Aquollic Hapludalfs for intergrades, and Arenic Hapludalfs for extragrades.

Families. Families are established within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, depth, slope, and consistence. A family name consists of a series of adjectives which are the class names for texture, mineralogy, and so on, that are used as family differentiae. An example is the fine, illitic, mesic family.

Series. The series is a group of soils having major horizons that, except for texture of surface layer, are similar in important characteristics and in arrangement in the profile. They are commonly given the name of a geographic location near the place where that series was first observed and mapped. Examples are the Owosso, Adrian, and Macomb series.

Climate [7]

The inland location of Washtenaw County in southeast Michigan minimizes the Great Lakes' influence on the climate. The most noticeable affect of this influence is the increased cloudiness, which moderates the minimum temperature during cold air outbreaks late in fall and early in winter. The continental character of the climate is reflected by the larger daily, seasonal, and annual temperature changes at, for example, Ann Arbor, as compared with stations nearer the Great Lakes and at a similar latitude. Because the day-to-day weather is controlled chiefly by the movement of pressure systems across the nation, there are seldom prolonged periods of either hot, humid weather in summer or extreme cold during the winter. Climatological data for the county are given in tables 11, 12, and 13.

The highest temperature on record is 105° F on July 24, 1934, and the lowest, −21° F on February 10, 1912. The warmest monthly mean temperature was 77.6° F during July 1955, and the coldest was 11.4° F in January 1918. On the average, the temperature is 90° F or higher 13 days per year. Twice during the 1940–1969 period the temperature reached or exceeded 100° F—on July 2 and 3, 1966. During the same period, 7 years had no record of a below-zero temperature. The influence of the lake is reflected in the milder minimum temperatures. On an average, 81 percent of the time minimum temperatures from November through March are 32° F or below, but only 3 days per year experience below-zero temperatures. The average heating and cooling degree days, base 65° F, are 6,301 and 769 respectively. January, the coldest month, has an average of 1,239 heating degree days, and July, the warmest month, has an average of 6 heating degree days and 253 cooling degree days.

The growing season averages 172 days. The average date of the last freezing temperature in spring is April 29, and the average date of the first freezing temperature in fall is October 18.

Precipitation is well distributed throughout the year. The crop season from May to October receives an average of 17.22 inches, or 56 percent of the average annual total of 30.48 inches. June has an average of 3.62 inches and is the wettest month. February has an average of 1.65 inches and is the driest month. Summer precipitation is mainly in the form of afternoon showers and thundershowers. Thunderstorms occur on an average of 36 days a year. The greatest monthly precipitation total on record was 10.70 inches in July 1902. The driest month on record was August 1894, when only a trace of precipitation was observed. The greatest daily total, 3.70 inches, fell on April 4, 1947, while the greatest

[7] FRED V. NURNBERGER, meteorologist for Michigan, National Weather Service, U.S. Department of Commerce, helped prepare this section.

TABLE 11.—*Temperature and precipitation*

[Based on National Weather Service climatological observations at Ann Arbor, Michigan, 1940–1969. Snow data are the Jackson and Detroit metropolitan areas]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with:		Average total	One year in 10 will have		Average number of days with 1 inch or more snow cover	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than	Minimum temperature equal to or lower than		Less than	More than		
	°F	°F	°F	°F	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	31.8	17.7	48	11	1.82	0.62	3.30	19	3.2
February	34.3	19.1	48	13	1.65	.46	3.16	16	3.4
March	43.8	26.4	66	20	2.31	1.02	3.84	8	2.8
April	58.7	37.9	77	33	3.21	1.51	5.19	1	2.2
May	69.6	48.0	85	41	3.25	1.25	5.69	0	0
June	79.8	58.2	91	52	3.62	1.77	5.78	0	0
July	83.4	62.0	92	57	2.90	1.31	4.79	0	0
August	81.5	60.4	91	55	2.77	1.51	4.23	0	0
September	74.4	53.2	88	46	2.19	.96	3.64	0	0
October	63.7	43.7	79	37	2.49	.60	4.93	0	0
November	47.7	32.7	64	26	2.26	1.16	3.53	4	2.3
December	35.4	22.4	52	16	2.15	.68	4.00	14	3.0
Year	58.7	40.1	[1] 95	[2] −4	30.48	23.63	37.77	62	2.8

[1] Average annual maximum temperature.
[2] Average annual minimum temperature.

TABLE 12.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data recorded at Ann Arbor for period 1931–60]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	March 30	April 7	April 17	April 29	May 14
2 years in 10 later than	March 25	April 2	April 12	April 24	May 9
5 years in 10 later than	March 15	March 23	April 2	April 14	April 29
Fall:					
1 year in 10 earlier than	November 15	November 9	October 29	October 18	October 2
2 years in 10 earlier than	November 20	November 14	November 3	October 23	October 7
5 years in 10 earlier than	December 1	November 25	November 14	November 3	October 18

TABLE 13.—*Probability of snow cover of specified depth before given dates* [1]

[At Ann Arbor. Based on depth of snow cover at time of daily observation]

Probability	Depth of snow cover			
	1 inch	3 inches	6 inches	12 inches
5 percent	November 2	November 3	November 20	January 15
10 percent	November 7	November 13	December 3	January 23
30 percent	November 18	December 4	January 2	
50 percent	November 26	December 18	January 16	
70 percent	December 4	January 3	February 19	
90 percent	December 15	January 26		

[1] "Michigan Snowfall Statistics: First 1-, 3-, 6-, 12-inch Depths," June 1968.

amount received in a 24-hour period was 4.74 inches on June 25–26, 1968. About once in 2 years, as much as 1.2 inches of rain falls in an hour, as much as 1.4 inches in 2 hours, and as much as 2.4 inches in 24 hours. About once in 10 years, as much as 3.4 inches falls in 24 hours, and once in 50 years, as much as 4.6 inches falls in 24 hours.

Michigan is on the northeast fringe of the midwest tornado belt. An average of 10 tornadoes a year occurred in the belt since 1950, but since 1900, only 11 tornadoes are known to have touched down in the county.

Data taken at Dearborn and East Lansing on evaporation from the class "A" pan show that during the crop season evaporation averages about 34.7 inches for the county. Because potential evaporation is more than double that amount, soil moisture replenishment during the fall and winter months is important to the success of farming in the county. Although drought may occur periodically, only 10 percent of the time will drought conditions reach extreme severity as indicated by the Palmer Drought Index.

Snowfall averages 29.5 inches per year but varies from the high of 72.0 inches recorded during the 1966–67 season, to the low of 6.5 inches during the 1965–66 season. The heaviest single day snowfall, 14.0 inches, occurred January 27, 1967, and the greatest recorded snow depth, 19 inches, was recorded that same day. See table 13 for probability of snow cover of selected depths before given dates. Measurable amounts of snow usually fall each month from November through May. Ann Arbor averages 55 days per season with 1 inch or more of snow on the ground.

The nearest National Weather Service station at which records of cloudiness and winds are kept is at Detroit Metropolitan Airport. Based upon 15 years of record, the average annual windspeed is 10.0 mph from the southwest. The months with the highest average windspeed are January and April at 11.3 mph from the west-southwest. Next highest are February and March at 11.2 mph, also from the west-southwest. August has the lowest average windspeed of 8.2 mph from the southwest. The fastest 1 minute sustained windspeed was 87 mph from the southwest on June 26, 1973.

Cloudy days are most common late in fall and early in winter and least common late in spring and summer. December averages 21 cloudy days, 7 partly cloudy days, and 3 clear days. August averages 10 cloudy, 11 partly cloudy, and 10 clear days. The annual average of percent of possible sunshine is 53 percent.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.
Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.
Area reclaim (engineering tables). Borrow areas hard to reclaim.
Association, soil. A group of soils geographically associated in a characteristic repeating pattern.
Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.
Board foot. The amount of wood in a board 1 foot wide, 1 foot long, and 1 inch thick; 144 cubic inches; 1/12 of a cubic foot.
Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.
Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.
Cobblestone. A rounded or partly rounded fragment of rock, 3 to 10 inches in diameter.
Cobbly. Soils have rounded or partially rounded fragment of rock ranging from 3 to 10 inches in diameter.
Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.
Complex slope. Slopes short and irregular.
Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.
Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard and brittle; little affected by moistening.
Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.
Contour stripcropping. Growing crops in strips that follow the contour or are parallel to terraces or diversions. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Cover crop. A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production; or a crop grown between trees and vines and in orchards and vineyards.

Cutbanks cave (engineering tables). Walls of cuts not stable.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fast intake (engineering tables). Water infiltrates rapidly.

Glacial outwash (geology). Cross-bedded gravel, sand, and silt deposited by melt water as it flowed from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.

Gravelly. Soils have rounded or angular fragments, not prominently flattened, up to 3 inches in diameter.

Green manure (agronomy). A crop grown for the purpose of being turned under in an early stage of maturity or soon after maturity for soil improvement.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this mineral is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed by lowering the water level or elevation of the land.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Low strength (engineering tables). Not enough strength to adequately support the load.

Mineral soil. Soil composed mainly of inorganic (mineral) material and low in content of organic material. Its bulk density is greater than that of organic soil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical mineral, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottling. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Muck. An organic soil consisting of fairly well decomposed organic material that is relatively high in mineral content, finely divided, and dark in color.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Organic soil. A general term applied to a soil or to a soil horizon that consists primarily of organic matter, such as peat soils, muck soils, and peaty soil layers. In chemistry, organic refers to the compounds of carbon.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Perks slowly (engineering tables). Water moves through soil too slowly.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. See Reaction, soil.

Piping (engineering tables). Water may form tunnels or pipelike cavities.

Plow layer. The soil ordinarily moved in tillage; equivalent to surface soil.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A

rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Shrink-swell (engineering tables). Soil shrinks on drying and expands significantly on wetting.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slow refill (engineering tables). Ponds fill slowly because of restricted soil permeability.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Soil variant. A soil having properties sufficiently different from those other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Refers to that part of the A horizon below the surface soil.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of B horizon; has no depth limit.

Taxadjunct. Soils that do not fit in a series recognized in the classification system, but so much like the soils of a defined series in morphology, composition, and behavior that little would be gained by adding a new series. They are named for the series they resemble.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Till plain (geology). A level or undulating land surface covered by till, which is unstratified glacial drift consisting of clay, sand, gravel, and boulders intermingled; also known as ground moraine.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Underlying material. Any layer beneath the solum.

Valley train. The material deposited by the stream in the valley below a glacier.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

Map symbol	Mapping unit	Page	Capability unit: Symbol	Capability unit: Michigan management group	Capability unit: Page	Woodland group: Symbol	Woody plant group: Number	Recreation group: Number
Ad	Adrian muck	10	IVw-1	(M/4c)	56	4w2	1	1
BbA	Blount loam, 0 to 2 percent slopes	11	IIw-2	(1.5b)	52	2o4	2	2
BbB	Blount loam, 2 to 6 percent slopes	11	IIe-4	(1.5b)	52	2o4	2	2
BnB	Boyer loamy sand, 0 to 6 percent slopes	12	IIIs-1	(4a)	55	2s5	3	3
BnC	Boyer loamy sand, 6 to 12 percent slopes	12	IIIe-3	(4a)	54	2s5	3	4
BnD	Boyer loamy sand, 12 to 18 percent slopes	12	IVe-3	(4a)	56	2s5	3	5
BnE	Boyer loamy sand, 18 to 25 percent slopes	12	VIe-2	(4a)	57	2s6	3	5
BnF	Boyer loamy sand, 25 to 40 percent slopes	13	VIIe-1	(4a)	57	2s6	3	6
BoE	Boyer-Kidder complex, 15 to 35 percent slopes	13	VIe-2	(2.5a)	57	---	-	5
	Boyer soil	--	------	-------	--	2s6	3	--
	Kidder soil	--	------	-------	--	1r1	4	--
Br	Brookston loam	14	IIw-4	(2.5c)	53	2w1	5	7
Cc	Cohoctah fine sandy loam, frequently flooded	15	Vw-1	(L-2c)	57	2w1	5	8
CoB	Conover loam, 0 to 4 percent slopes	16	IIe-4	(2.5b)	52	2o4	2	9
CpA	Conover-Brookston loams, 0 to 2 percent slopes	16	IIw-4	(2.5b-2.5c)	53	---	-	--
	Conover soil	--	------	-------	--	2o4	2	9
	Brookston soil	--	------	-------	--	2w1	5	7
DoA	Dixboro-Kibbie fine sandy loams, 0 to 4 percent slopes	17	IIw-5	(3b-2.5b)	53	2o4	2	16
Ed	Edwards muck	17	IVw-2	(M/mc)	56	4w2	1	1
Ee	Edwards muck, shallow variant	18	IVw-2	(M/mc)	56	4w2	1	1
Fd	Fill land	18	------	-------	--	---	-	--
FoA	Fox sandy loam, 0 to 2 percent slopes	19	IIs-1	(3a)	53	1o1	4	10
FoB	Fox sandy loam, 2 to 6 percent slopes	19	IIe-3	(3a)	52	1o1	4	11
FoC	Fox sandy loam, 6 to 12 percent slopes	19	IIIe-6	(3a)	54	1o1	4	12
FoD	Fox sandy loam, 12 to 18 percent slopes	19	IVe-2	(3a)	56	1o1	4	13
FoE	Fox sandy loam, 18 to 25 percent slopes	20	VIe-2	(3a)	57	1r1	4	13
FpB	Fox cobbly sandy loam, cobbly variant, 2 to 6 percent slopes	21	IIIs-1	(Ga)	55	2f3	4	14
FpC	Fox cobbly sandy loam, cobbly variant, 6 to 12 percent slopes	21	IIIe-3	(Ga)	54	2f3	4	15
FpD	Fox cobbly sandy loam, cobbly variant, 12 to 18 percent slopes	21	IVe-3	(Ga)	56	2f3	4	15
Gf	Gilford sandy loam	22	IIIw-1	(4c)	55	3w1	5	7
Gr	Granby fine sand	23	IIIw-1	(5c)	55	5w1	5	7
Hn	Houghton muck	23	IIIw-3	(Mc)	55	4w2	1	1
Ho	Hoytville silty clay loam	24	IIw-2	(1c)	52	2w1	5	7
KeB	Kendallville loam, 2 to 6 percent slopes	25	IIe-2	(3/2a)	52	1o1	4	11
KeC	Kendallville loam, 6 to 12 percent slopes	25	IIIe-5	(3/2a)	54	1o1	4	12
KnA	Kibbie fine sandy loam, 0 to 4 percent slopes	25	IIw-5	(2.5b)	53	2o4	2	16
KrB	Kidder sandy loam, 2 to 6 percent slopes	26	IIe-2	(2.5a)	52	1o1	4	11

Map symbol	Mapping unit	Page	Capability unit			Woodland group	Woody plant group	Recreation group
			Symbol	Michigan management group	Page	Symbol	Number	Number
KrC	Kidder sandy loam, 6 to 12 percent slopes	26	IIIe-5	(2.5a)	54	1o1	4	12
KrD	Kidder sandy loam, 12 to 18 percent slopes	26	IVe-2	(2.5a)	56	1o1	4	13
Ln	Lamson-Colwood complex	27	IIw-5	(3c-2.5c)	53	3w1	5	7
MaA	Macomb loam, 0 to 4 percent slopes	28	IIe-4	(3/2b)	52	2o4	2	9
Mb	Made land	28	------	-------	--	---	-	--
MdA	Matherton sandy loam, 0 to 4 percent slopes	29	IIw-5	(3b)	53	2o4	2	16
MfA	Metamora sandy loam, 0 to 4 percent slopes	29	IIw-3	(3/2b)	53	2o4	2	9
MmB	Miami loam, 2 to 6 percent slopes	30	IIe-2	(2.5a)	52	1o1	4	11
MmC	Miami loam, 6 to 12 percent slopes	30	IIIe-5	(2.5a)	54	1o1	4	12
MmD	Miami loam, 12 to 18 percent slopes	30	IVe-2	(2.5a)	56	1o1	4	13
MmE	Miami loam, 18 to 25 percent slopes	30	VIe-1	(2.5a)	57	1r1	4	13
MmF	Miami loam, 25 to 35 percent slopes	31	VIIe-1	(2.5a)	57	1r1	4	6
MoB	Morley loam, 2 to 6 percent slopes	31	IIe-1	(1.5a)	52	2o2	4	17
MoC	Morley loam, 6 to 12 percent slopes	32	IIIe-4	(1.5a)	54	2o2	4	18
MoD	Morley loam, 12 to 18 percent slopes	32	IVe-1	(1.5a)	55	2o2	4	13
MoE	Morley loam, 18 to 25 percent slopes	32	VIe-1	(1.5a)	57	2r2	4	13
NaA	Nappanee silty clay loam, 0 to 2 percent slopes	33	IIIw-2	(1b)	55	2c1	2	19
NaB	Nappanee silty clay loam, 2 to 6 percent slopes	33	IIIe-7	(1b)	54	2c1	2	19
OaB	Oakville fine sand, 0 to 6 percent slopes	33	IVs-1	(5a)	56	2s5	3	20
OaC	Oakville fine sand, 6 to 12 percent slopes	33	IVs-1	(5a)	56	2s5	3	20
OsB	Oshtemo loamy sand, 0 to 6 percent slopes	34	IIIs-1	(4a)	55	2s5	3	3
OsC	Oshtemo loamy sand, 6 to 12 percent slopes	34	IIIe-3	(4a)	54	2s5	3	4
OwB	Owosso-Miami complex, 2 to 6 percent slopes	35	IIe-2	(3/2a-2.5a)	52	1o1	4	11
OwC	Owosso-Miami complex, 6 to 12 percent slopes	35	IIIe-5	(3/2a-2.5a)	54	1o1	4	12
Pa	Palms muck	36	IIw-1	(M/3c)	52	4w2	1	1
Pc	Pella silt loam	37	IIw-5	(2.5c)	53	3w1	5	7
Pe	Pewamo clay loam	38	IIw-2	(1.5c)	52	2w1	5	7
RdB	Riddles sandy loam, 2 to 6 percent slopes	39	IIe-2	(2.5a)	52	1o1	4	11
RdC	Riddles sandy loam, 6 to 12 percent slopes	39	IIIe-5	(2.5a)	54	1o1	4	12
Sb	Sebewa loam	40	IIw-5	(3c)	53	2w1	5	7
SeB	Seward loamy fine sand, 2 to 6 percent slopes	41	IIIs-1	(4/1a)	55	1o1	4	3
SeC	Seward loamy fine sand, 6 to 12 percent slopes	41	IIIe-3	(4/1a)	54	1o1	4	4

Map symbol	Mapping unit	Page	Capability unit			Woodland group	Woody plant group	Recreation group
			Symbol	Michigan management group	Page	Symbol	Number	Number
SfB	Seward sandy loam, loamy subsoil variant, 2 to 6 percent slopes	42	IIe-2	(3/1a)	52	1o1	4	17
SnB	Sisson fine sandy loam, 2 to 6 percent slopes	42	IIe-2	(2.5a)	52	1o1	4	11
SnC	Sisson fine sandy loam, 6 to 12 percent slopes	42	IIIe-5	(2.5a)	54	1o1	4	12
So	Sloan silt loam, wet	43	Vw-1	(L-2c)	57	2w1	5	8
SpB	Spinks loamy sand, 0 to 6 percent slopes	44	IIIs-1	(4a)	55	2s5	3	3
SpC	Spinks loamy sand, 6 to 12 percent slopes	44	IIIe-3	(4a)	54	2s5	3	4
SpD	Spinks loamy sand, 12 to 18 percent slopes	44	IVe-3	(4a)	56	2s5	3	5
SpF	Spinks loamy sand, 18 to 25 percent slopes	44	VIe-2	(4a)	57	2s6	3	5
SrB	Spinks-Oshtemo loamy sands, 0 to 6 percent slopes	45	IIIs-1	(4a)	55	2s5	3	3
StB	St. Clair clay loam, 2 to 6 percent slopes	46	IIIe-1	(1a)	53	2c1	2	21
StC	St. Clair clay loam, 6 to 12 percent slopes	46	IIIe-2	(1a)	54	2c1	2	22
StD	St. Clair clay loam, 12 to 18 percent slopes	46	IVe-1	(1a)	55	2c1	2	22
StE	St. Clair clay loam, 18 to 35 percent slopes	46	VIe-1	(1a)	57	2c2	2	23
TeA	Tedrow loamy fine sand, 0 to 4 percent slopes	47	IIIw-4	(5b)	55	3s3	2	24
ThA	Thetford loamy sand, 0 to 4 percent slopes	48	IIIw-4	(4b)	55	3s3	2	24
WaA	Wasepi sandy loam, 0 to 4 percent slopes	48	IIIw-4	(4b)	55	3s3	2	16
Ws	Wauseon fine sandy loam	49	IIw-3	(3/1c)	53	2w1	5	7
YpA	Ypsi sandy loam, 0 to 4 percent slopes	50	IIw-3	(3/1b)	53	2o4	2	2

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MICHIGAN AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
WASHTENAW COUNTY, MICHIGAN

Scale 1:190,080
1 0 1 2 3 4 Miles

N

SOIL ASSOCIATIONS

NEARLY LEVEL TO VERY STEEP, WELL DRAINED SOILS THAT ARE UNDERLAIN BY COARSE TEXTURED AND MODERATELY COARSE TEXTURED MATERIAL AND NEARLY LEVEL, VERY POORLY DRAINED ORGANIC SOILS

1 — Boyer-Spinks-Houghton association: Nearly level to very steep, well drained soils that have a moderately coarse textured or coarse textured subsoil and coarse textured underlying material and nearly level, very poorly drained organic soils; in outwash areas

2 — Boyer-Kidder-Houghton association: Nearly level to very steep, well drained soils that have a moderately coarse textured or moderately fine textured subsoil and coarse textured or moderately coarse textured underlying material and nearly level, very poorly drained organic soils; on moraines

NEARLY LEVEL TO STEEP, WELL DRAINED TO VERY POORLY DRAINED SOILS THAT ARE UNDERLAIN BY COARSE TEXTURED MATERIAL

3 — Boyer-Fox-Sebewa association: Nearly level to steep, well drained and very poorly drained soils that have a moderately coarse textured to moderately fine textured subsoil and coarse textured underlying material; on outwash plains, valley trains, terraces, and moraines

4 — Spinks-Boyer-Wasepi association: Nearly level to moderately steep, well drained and somewhat poorly drained soils that have a coarse textured or moderately coarse textured subsoil and coarse textured underlying material; on outwash plains, terraces, lake plains, and deltas

5 — Fox-Boyer-Fox variant association: Nearly level to moderately steep, well drained soils that have a moderately fine textured or moderately coarse textured subsoil and coarse textured underlying material; on moraines and outwash plains

NEARLY LEVEL TO VERY STEEP, WELL DRAINED TO VERY POORLY DRAINED SOILS THAT ARE UNDERLAIN BY MEDIUM TEXTURED TO FINE TEXTURED GLACIAL TILL MATERIAL

6 — Miami-Conover-Brookston association: Nearly level to very steep, well drained to very poorly drained soils that have a medium textured and moderately fine textured subsoil and medium textured underlying material; on till plains and moraines

7 — Morley-Blount association: Nearly level to steep, well drained to somewhat poorly drained soils that have a moderately fine textured and fine textured subsoil and moderately fine textured underlying material; on moraines and till plains

8 — St. Clair-Nappanee-Hoytville association: Nearly level to very steep, moderately well drained to very poorly drained soils that have a fine textured subsoil and fine textured underlying material; on moraines, till plains, and lake plains

NEARLY LEVEL AND GENTLY SLOPING, SOMEWHAT POORLY TO VERY POORLY DRAINED SOILS THAT ARE UNDERLAIN BY COARSE TEXTURED TO FINE TEXTURED MATERIAL

9 — Wasepi-Gilford association: Nearly level and gently sloping, somewhat poorly drained and very poorly drained soils that have a mainly moderately coarse textured subsoil and coarse textured underlying material; on deltas and lake plains

10 — Hoytville-Nappanee association: Nearly level and gently sloping, very poorly drained and somewhat poorly drained soils that have a fine textured subsoil and fine textured underlying material; on till plains and lake plains

11 — Ypsi-Kibbie-Pella association: Nearly level and gently sloping, somewhat poorly drained to very poorly drained soils that have a coarse textured to moderately fine textured subsoil and fine textured to coarse textured underlying material; on lake plains and deltas

12 — Granby-Thetford-Dixboro association: Nearly level and gently sloping, somewhat poorly drained to very poorly drained soils that have a coarse textured or moderately coarse textured subsoil and coarse textured to medium textured underlying material; on lake plains

Compiled 1972

SECTIONALIZED TOWNSHIP

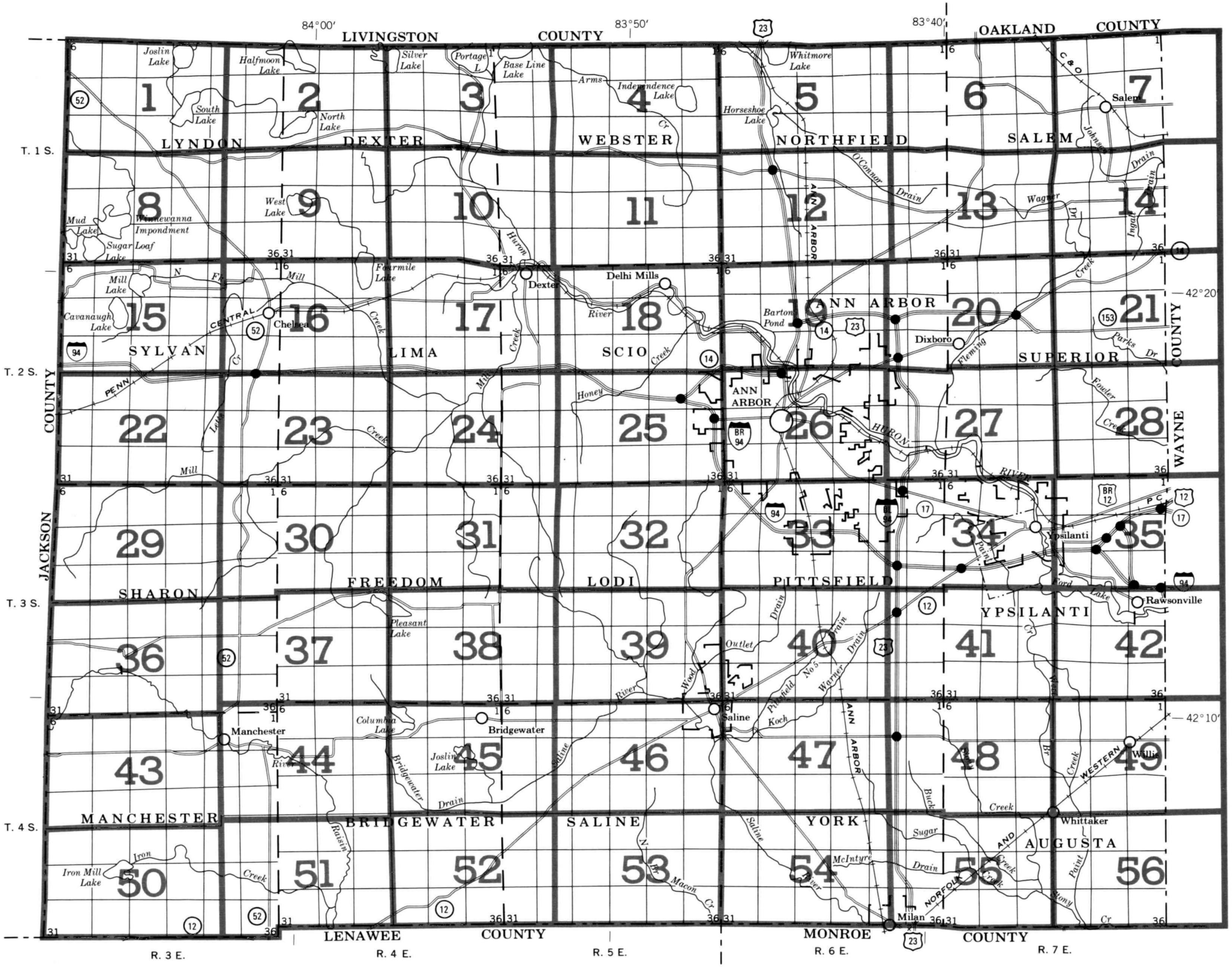
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

INDEX TO MAP SHEETS
WASHTENAW COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 4 Miles



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

The first capital letter is the first letter of the soil name. The lower case letter that follows separates mapping units beginning with the same capital letter, except for sloping phases. A second capital letter indicates the slope class. Symbols without slope letters are for nearly level soils or for miscellaneous land types which may have a wide slope range.

SYMBOL	NAME
Ad	Adrian muck
BbA	Blount loam, 0 to 2 percent slopes
BbB	Blount loam, 2 to 6 percent slopes
BnB	Boyer loamy sand, 0 to 6 percent slopes
BnC	Boyer loamy sand, 6 to 12 percent slopes
BnD	Boyer loamy sand, 12 to 18 percent slopes
BnE	Boyer loamy sand, 18 to 25 percent slopes
BnF	Boyer loamy sand, 25 to 40 percent slopes
BoE	Boyer-Kidder complex, 15 to 35 percent slopes
Br	Brookston loam
Cc	Cohoctah fine sandy loam, frequently flooded
CoB	Conover loam, 0 to 4 percent slopes
CpA	Conover-Brookston loams, 0 to 2 percent slopes
DoA	Dixboro-Kibbie fine sandy loams, 0 to 4 percent slopes
Ed	Edwards muck
Ee	Edwards muck, shallow variant
Fd	Fill land
FoA	Fox sandy loam, 0 to 2 percent slopes
FoB	Fox sandy loam, 2 to 6 percent slopes
FoC	Fox sandy loam, 6 to 12 percent slopes
FoD	Fox sandy loam, 12 to 18 percent slopes
FoE	Fox sandy loam, 18 to 25 percent slopes
FpB	Fox cobbly sandy loam, cobbly variant, 2 to 6 percent slopes
FpC	Fox cobbly sandy loam, cobbly variant, 6 to 12 percent slopes
FpD	Fox cobbly sandy loam, cobbly variant, 12 to 18 percent slopes
Gf	Gilford sandy loam
Gr	Granby fine sand
Hn	Houghton muck
Ho	Hoytville silty clay loam
KeB	Kendallville loam, 2 to 6 percent slopes
KeC	Kendallville loam, 6 to 12 percent slopes
KnA	Kibbie fine sandy loam, 0 to 4 percent slopes
KrB	Kidder sandy loam, 2 to 6 percent slopes
KrC	Kidder sandy loam, 6 to 12 percent slopes
KrD	Kidder sandy loam, 12 to 18 percent slopes
Ln	Lamson-Colwood complex
MaA	Macomb loam, 0 to 4 percent slopes
Mb	Made land
MdA	Matherton sandy loam, 0 to 4 percent slopes
MfA	Metamora sandy loam, 0 to 4 percent slopes
MmB	Miami loam, 2 to 6 percent slopes
MmC	Miami loam, 6 to 12 percent slopes
MmD	Miami loam, 12 to 18 percent slopes
MmE	Miami loam, 18 to 25 percent slopes
MmF	Miami loam, 25 to 35 percent slopes
MoB	Morley loam, 2 to 6 percent slopes
MoC	Morley loam, 6 to 12 percent slopes
MoD	Morley loam, 12 to 18 percent slopes
MoE	Morley loam, 18 to 25 percent slopes
NaA	Nappanee silty clay loam, 0 to 2 percent slopes
NaB	Nappanee silty clay loam, 2 to 6 percent slopes
OaB	Oakville fine sand, 0 to 6 percent slopes
OaC	Oakville fine sand, 6 to 12 percent slopes
OsB	Oshtemo loamy sand, 0 to 6 percent slopes
OsC	Oshtemo loamy sand, 6 to 12 percent slopes
OwB	Owosso-Miami complex, 2 to 6 percent slopes
OwC	Owosso-Miami complex, 6 to 12 percent slopes
Pa	Palms muck
Pc	Pella silt loam
Pe	Pewamo clay loam
RdB	Riddles sandy loam, 2 to 6 percent slopes
RdC	Riddles sandy loam, 6 to 12 percent slopes
Sb	Sebewa loam
SeB	Seward loamy fine sand, 2 to 6 percent slopes
SeC	Seward loamy fine sand, 6 to 12 percent slopes
SfB	Seward sandy loam, loamy subsoil variant, 2 to 6 percent slopes
SnB	Sisson fine sandy loam, 2 to 6 percent slopes
SnC	Sisson fine sandy loam, 6 to 12 percent slopes
So	Sloan silt loam, wet
SpB	Spinks loamy sand, 0 to 6 percent slopes
SpC	Spinks loamy sand, 6 to 12 percent slopes
SpD	Spinks loamy sand, 12 to 18 percent slopes
SpE	Spinks loamy sand, 18 to 25 percent slopes
SrB	Spinks-Oshtemo loamy sands, 0 to 6 percent slopes
StB	St. Clair clay loam, 2 to 6 percent slopes
StC	St. Clair clay loam, 6 to 12 percent slopes
StD	St. Clair clay loam, 12 to 18 percent slopes
StE	St. Clair clay loam, 18 to 35 percent slopes
TeA	Tedrow loamy fine sand, 0 to 4 percent slopes
ThA	Thetford loamy sand, 0 to 4 percent slopes
WaA	Wasepi sandy loam, 0 to 4 percent slopes
Ws	Wauseon fine sandy loam
YpA	Ypsi sandy loam, 0 to 4 percent slopes

WASHTENAW COUNTY, MICHIGAN — SHEET NUMBER 1

WASHTENAW COUNTY, MICHIGAN NO. 1

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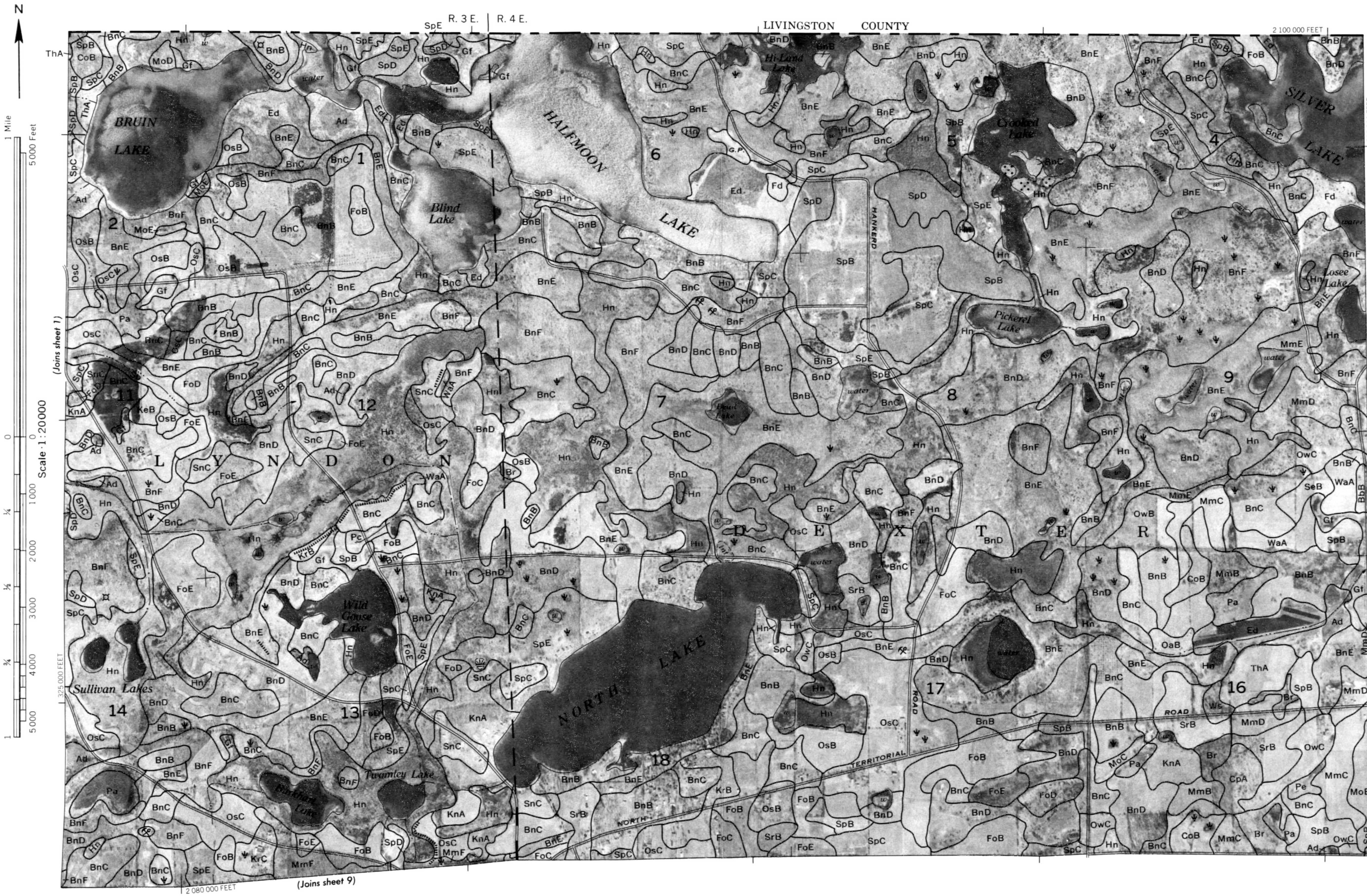
WASHTENAW COUNTY, MICHIGAN — SHEET NUMBER 2



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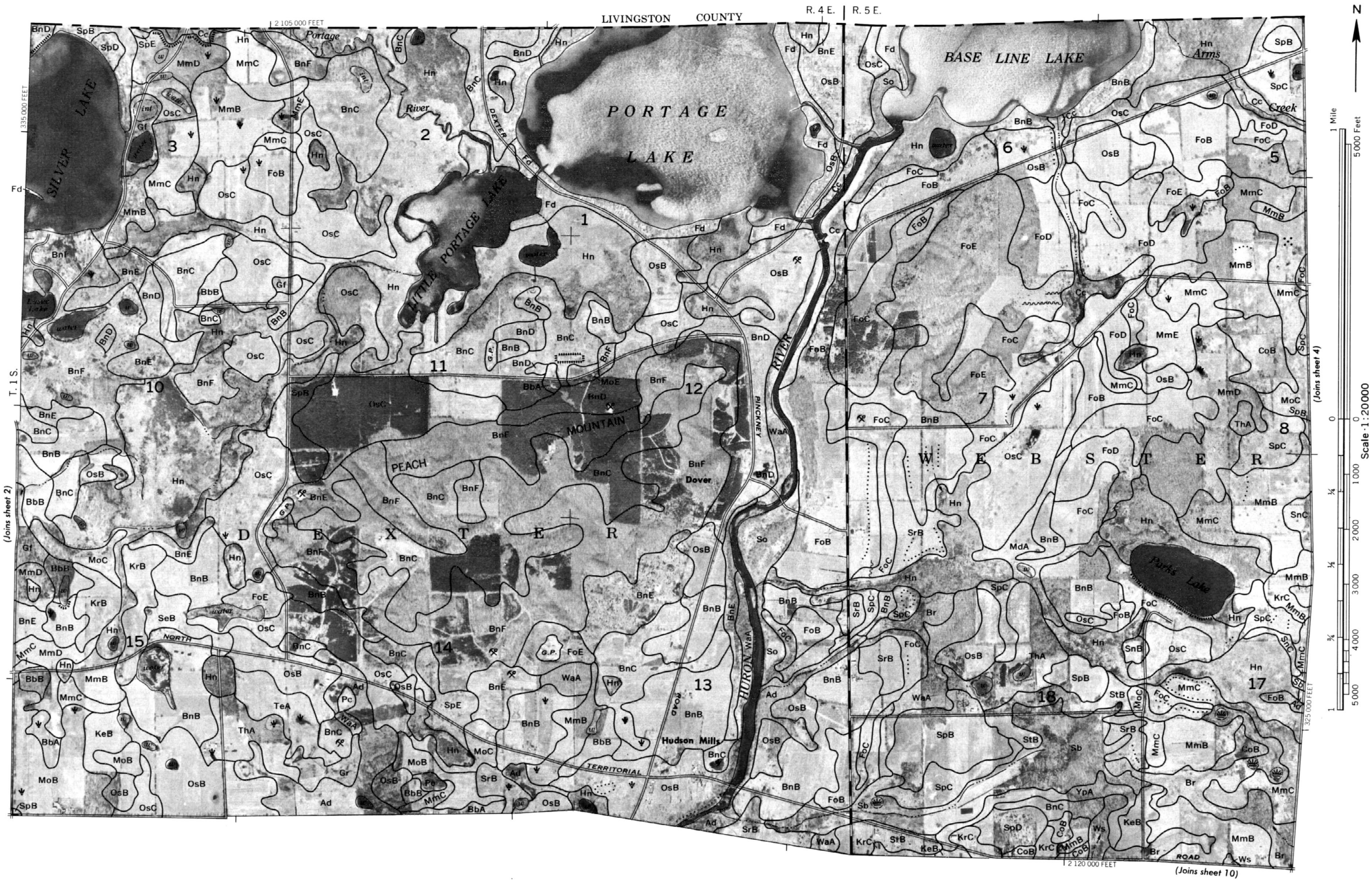
WASHTENAW COUNTY, MICHIGAN NO. 2



WASHTENAW COUNTY, MICHIGAN NO. 3

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(4)

N

LIVINGSTON COUNTY

R. 5 E.

T. 1 S.

2 145 000 FEET

335 000 FEET

325 000 FEET

2 125 000 FEET

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 3)

(Joins sheet 11)

(Joins sheet 5)

Arms Lake

Arms Creek

GRAVEL PIT

INDEPENDENCE LAKE

NORTH TERRITORIAL ROAD

Webster

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WASHTENAW COUNTY, MICHIGAN NO. 4

WASHTENAW COUNTY, MICHIGAN NO. 5

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 150 000 FEET

335 000 FEET

T. 1 S.

R. 6 E.

LIVINGSTON COUNTY

WHITMORE LAKE

DEAD LAKE

Lawton Lake

Horseshoe Lake

Round Lake

ANN ARBOR

OLD ORCHARD

SIX MILE ROAD

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 12)

325 000 FEET

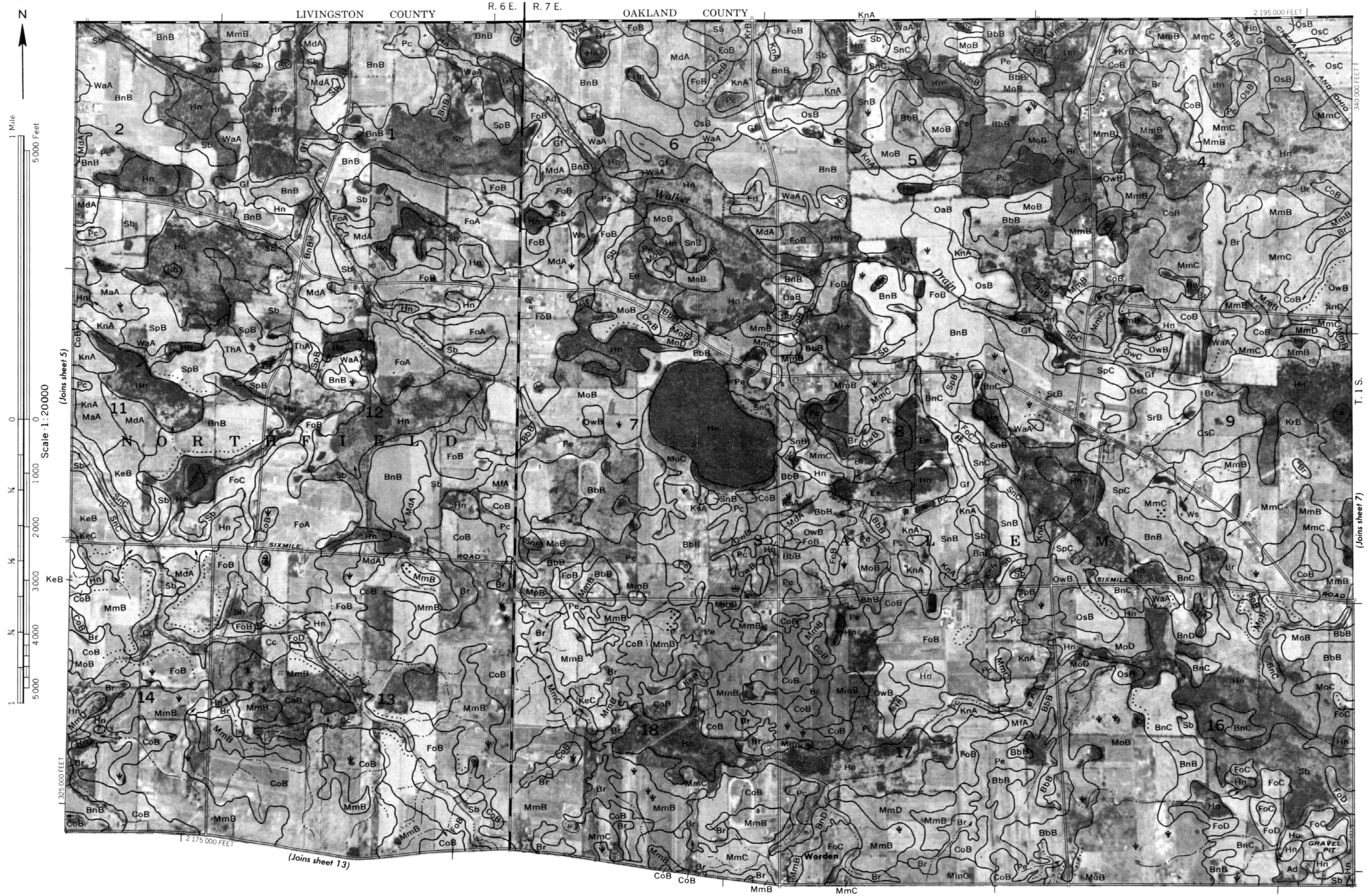
2 170 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20000



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WASHTENAW COUNTY, MICHIGAN NO. 7

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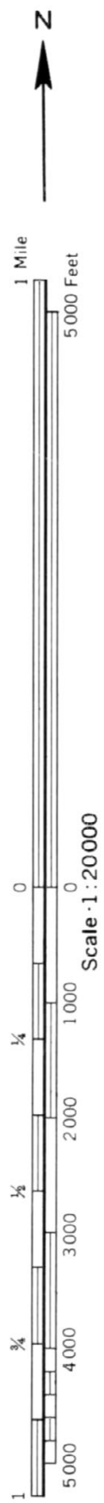
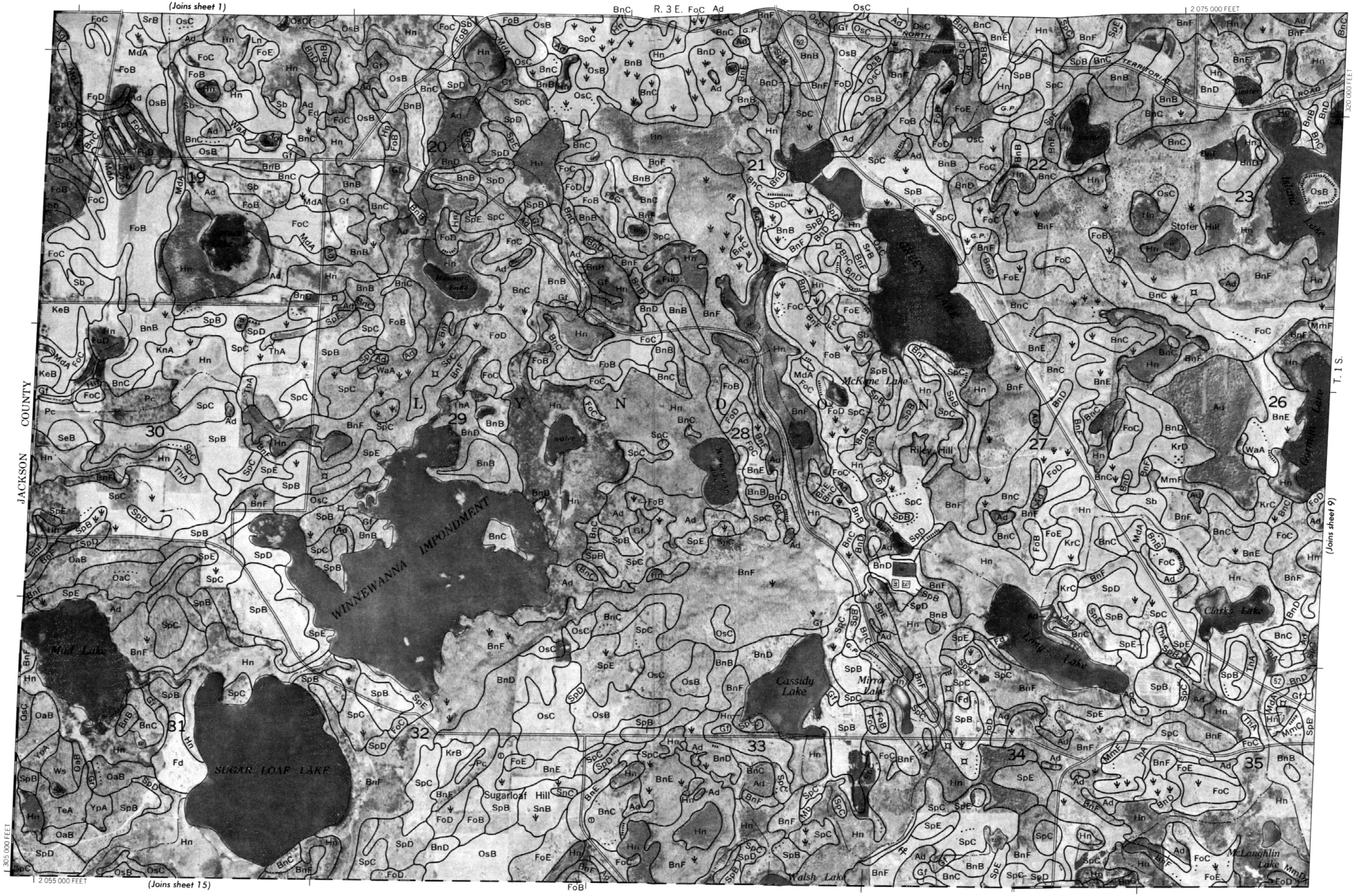
WASHTENAW COUNTY, MICHIGAN — SHEET NUMBER 8





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WASHTENAW COUNTY, MICHIGAN NO. 9

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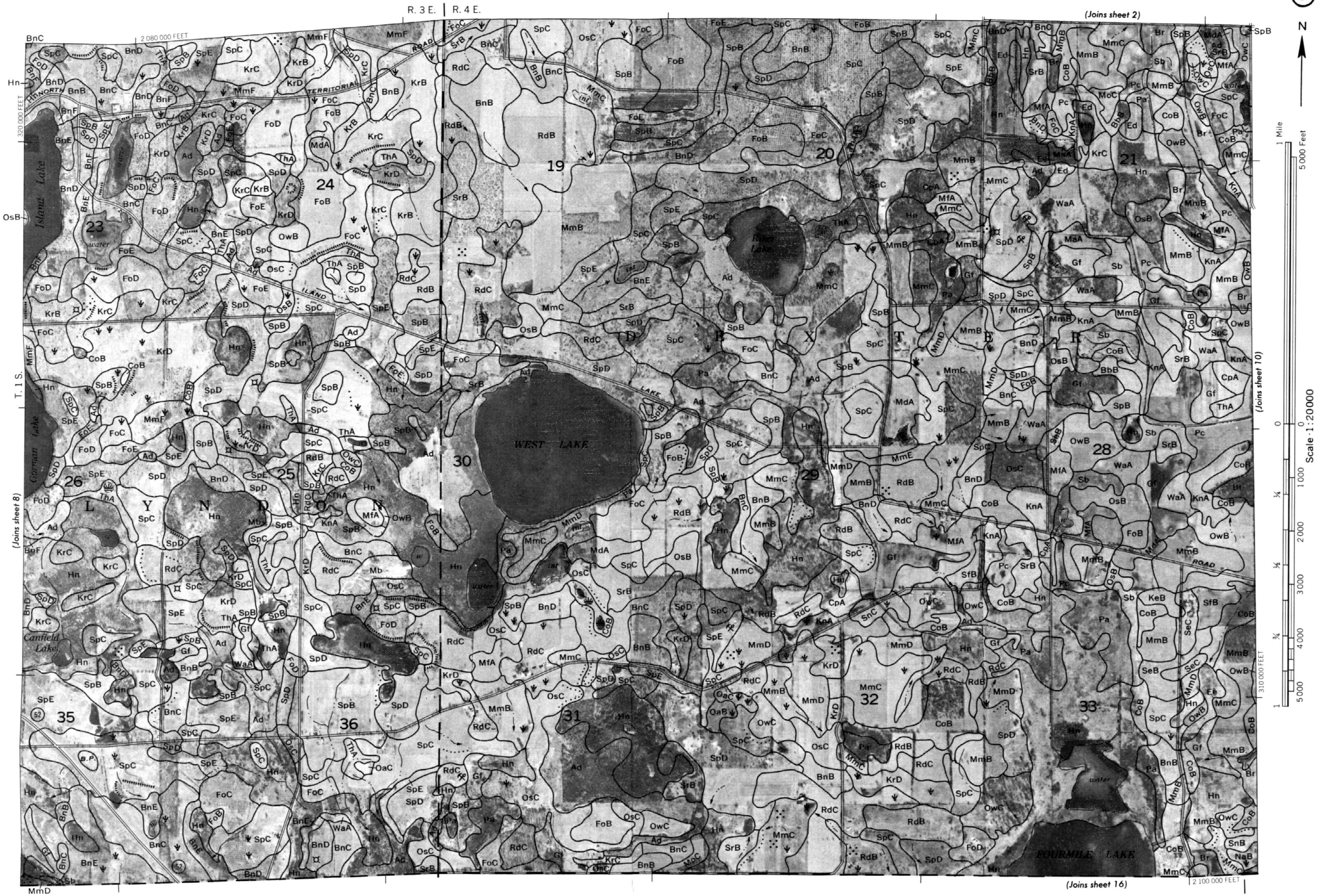

10

N

Scale 1:20000

1 Mile 5000 Feet

(Joins sheet 3)

(Joins sheet 9)

(Joins sheet 17)

R. 4 E. | R. 5 E.

T. 1 S.

2 120 000 FEET

320 000 FEET

310 000 FEET

2 105 000 FEET

(Joins sheet 11)

HURON RIVER

DEXTER

PINCKNEY

ISLAND LAKE ROAD

Dexter

WASHTENAW COUNTY, MICHIGAN NO. 10

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WASHTENAW COUNTY, MICHIGAN NO. 11

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2 125 000 FEET

R. 5 E.

(Joins sheet 4)

320 000 FEET

T. 1 S.

(Joins sheet 10)

(Joins sheet 12)

310 000 FEET

(17) | (Joins sheet 18)

2 145 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

WASHTENAW COUNTY, MICHIGAN — SHEET NUMBER 12

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WASHTENAW COUNTY, MICHIGAN NO. 12

2 175 000 FEET

R. 6 E.

R. 7 E.

(Joins sheet 6)

320 000 FEET

T. 1 S.

N O R T H F I E L D

S A L E M

LELAND CEMETERY

TERRITORIAL ROAD

Emery

(Joins sheet 12)

(Joins sheet 14)

(Joins sheet 20)

2 195 000 FEET

310 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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Coordinate grid ticks and land division corners, if shown, are approximately positioned

WASHTENAW COUNTY, MICHIGAN NO. 15

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R. 3 E.

T. 2 S.

JACKSON COUNTY

2 055 000 FEET

300 000 FEET

(Joins sheet 8)

(Joins sheet 16)

(Joins sheet 22)

2 075 000 FEET

290 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

MILL LAKE

CROOKED LAKE

CAVANAUGH LAKE

Glacier Lake

Mud Lakes

Lehman Lake

Cedar Lake

Double Lake

North Fork Mill Creek

CENTRAL PENN

16

N

R. 3 E. | R. 4 E.

(Joins sheet 9)

(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 23)

2 100 000 FEET

305 000 FEET

290 000 FEET

2 080 000 FEET

T. 2 S.

1 Mile

5000 Feet

0 0

Scale · 1:20000

1 5000 | ¾ 4000 | ½ 3000 | ¼ 2000 | 0 1000

Mill Creek

North Fork Lotts Creek

Lotts Creek

Fourmile Creek

Fourmile Lake

PENN CENTRAL

CHELSEA

SYLVAN

LIMA

GRAVEL PIT

G.P.

WASHTENAW COUNTY, MICHIGAN NO. 16

WASHTENAW COUNTY, MICHIGAN NO. 17

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Coordinate grid ticks and land division corners, if shown, are approximately positioned

2 105 000 FEET

305 000 FEET

T. 2 S.

R. 4 E. | R. 5 E.

(Joins sheet 10) (11)

(Joins sheet 16)

(Joins sheet 18)

(Joins sheet 24)

2 125 000 FEET

295 000 FEET

Prospect Hill

Dexter

ST JOSEPH CEMETERY

Faith Church

LIMA CEMETERY

Vardimon Lake

PENN CENTRAL

MICHIGAN CENTRAL

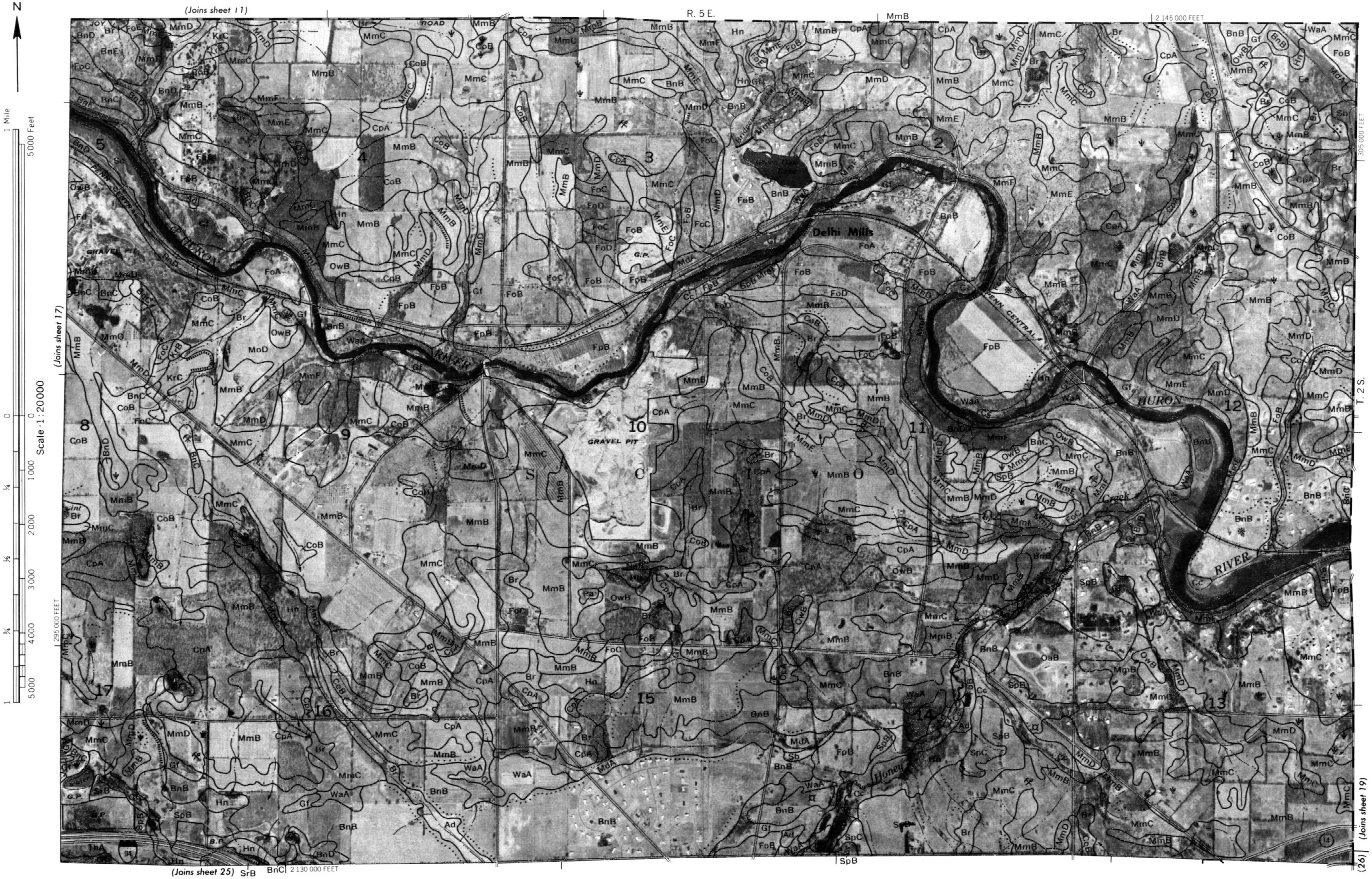
N

1 Mile

5000 Feet

Scale 1:20000

WASHTENAW COUNTY, MICHIGAN — SHEET NUMBER 18



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WASHTENAW COUNTY, MICHIGAN NO. 18

WASHTENAW COUNTY, MICHIGAN NO. 19

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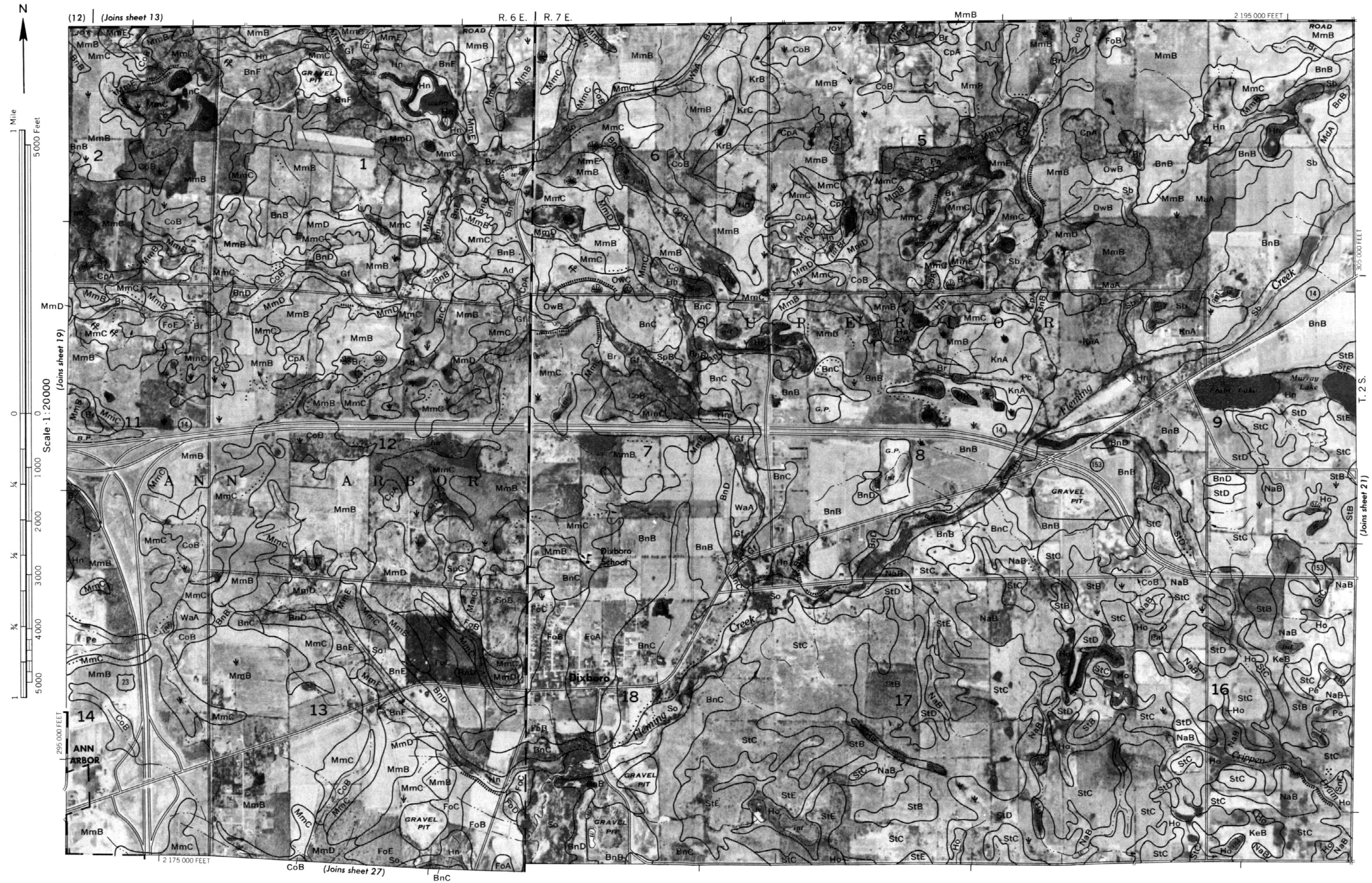

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WASHTENAW COUNTY, MICHIGAN NO. 21

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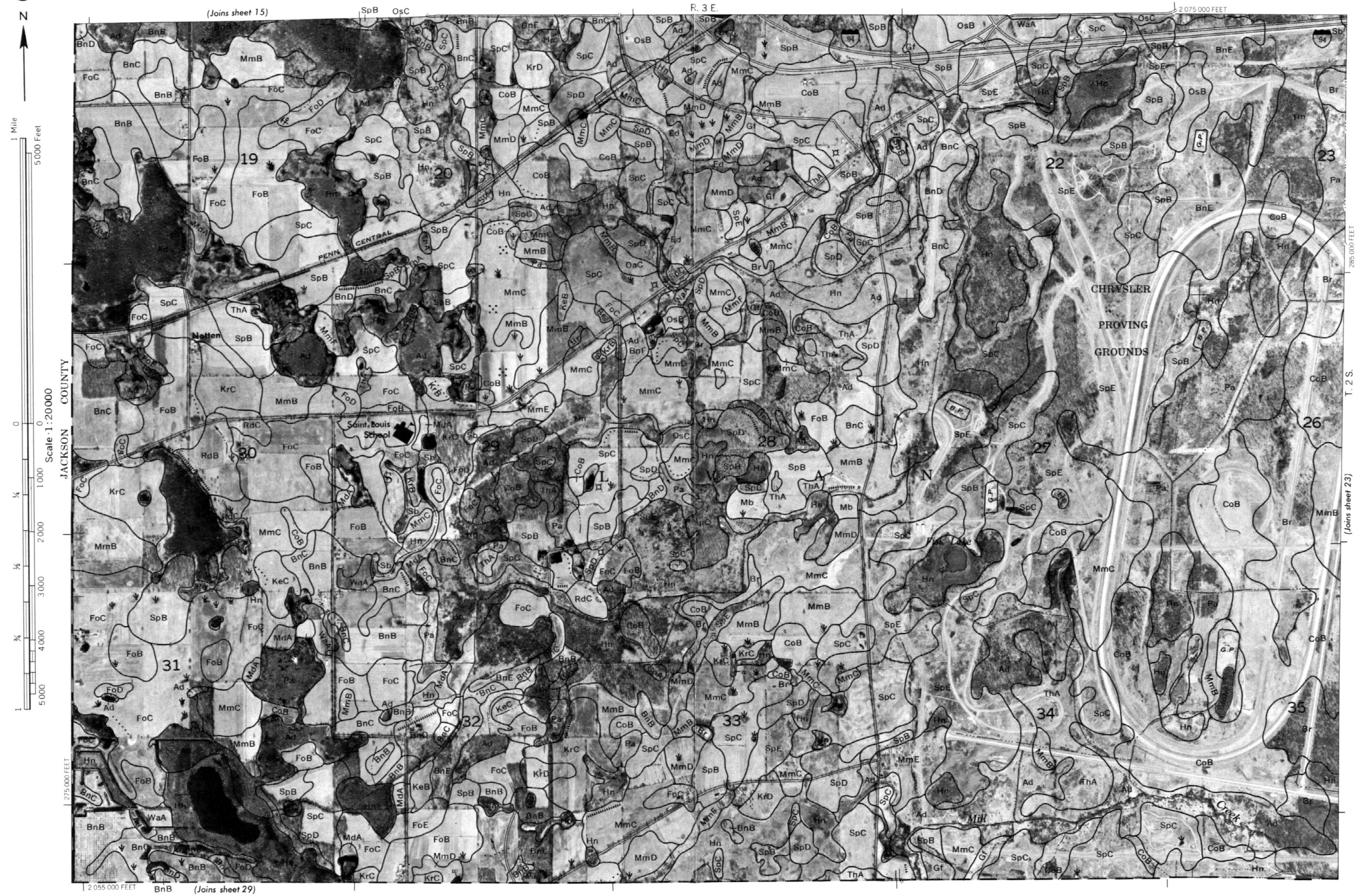
WASHTENAW COUNTY, MICHIGAN — SHEET NUMBER 22



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WASHTENAW COUNTY, MICHIGAN NO. 22

WASHTENAW COUNTY, MICHIGAN NO. 23

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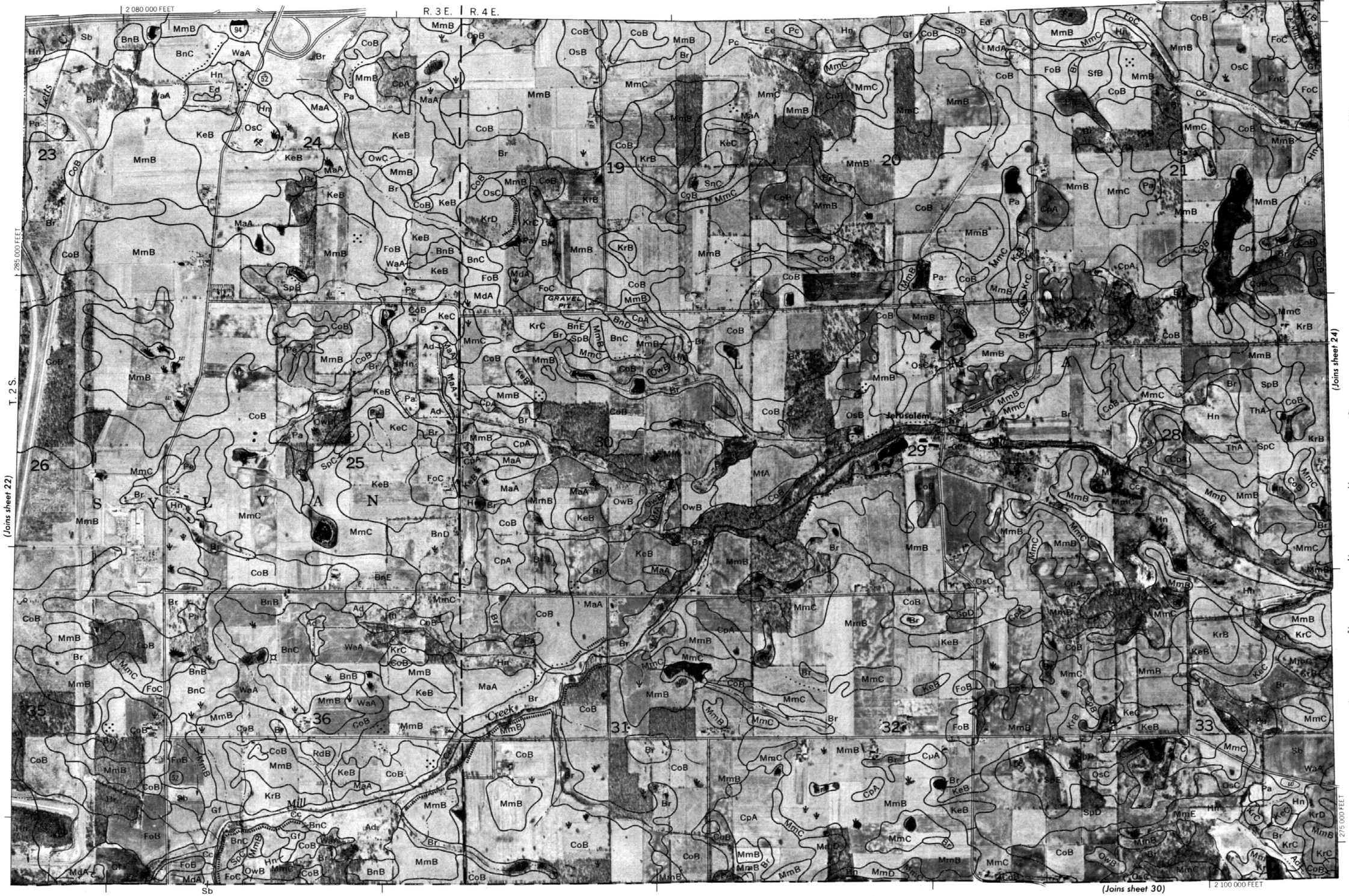
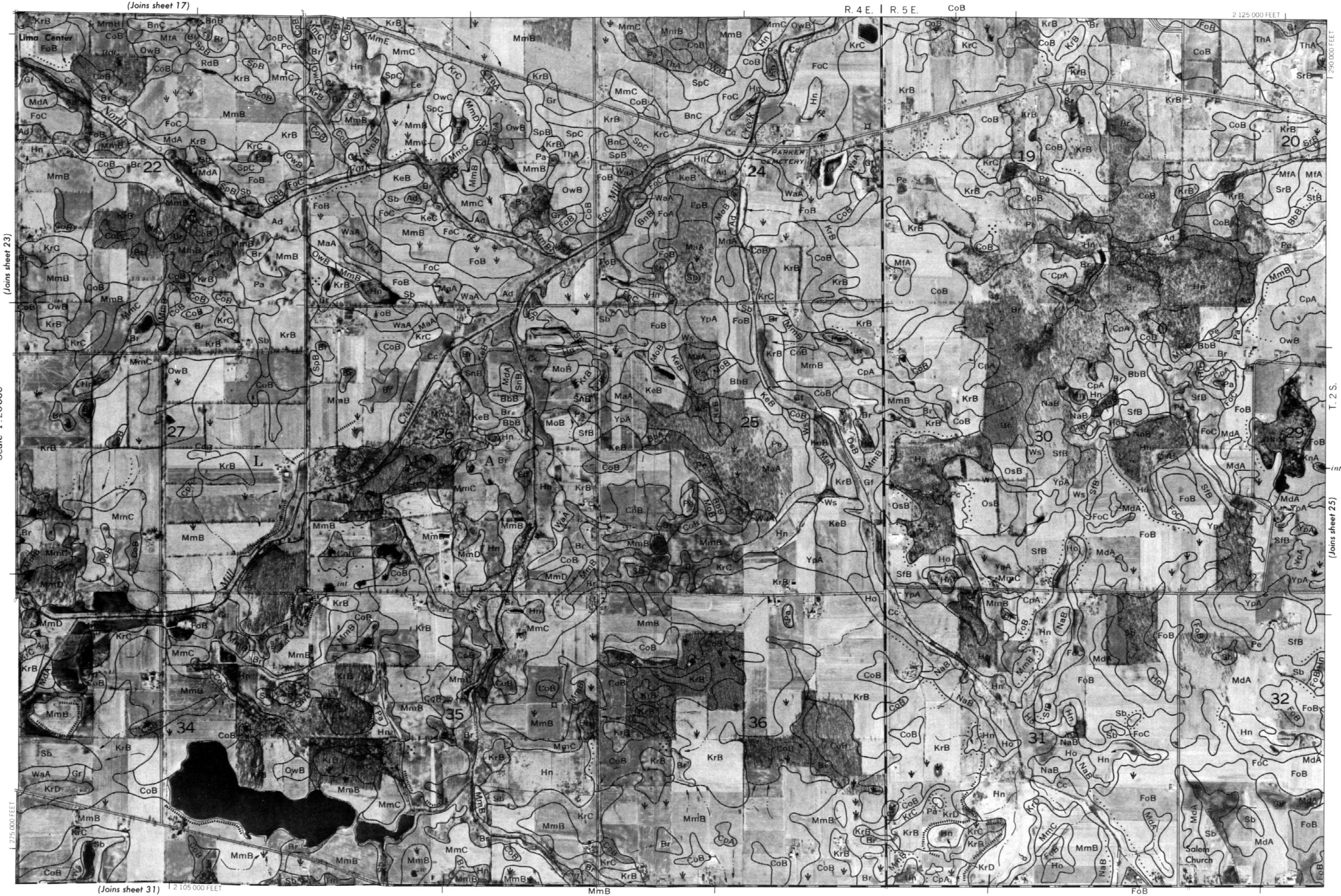
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



WASHTENAW COUNTY, MICHIGAN — SHEET NUMBER 24



1 Mile
5000 Feet
Scale · 1:20000
0
1000
2000
3000
4000
5000

This map is compiled on 1959 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

WASHTENAW COUNTY, MICHIGAN NO. 24

WASHTENAW COUNTY, MICHIGAN NO. 25

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

25

N

R. 5 E.

2 130 000 FEET

290 000 FEET

T. 2 S.

(Joins sheet 18)

(Joins sheet 24)

(Joins sheet 26)

(Joins sheet 32)

2 145 000 FEET

280 000 FEET

YOUNG AIRPORT

ANN ARBOR (county seat)

SCIO

URBAN LAND

BETHLEHEM CEMETERY

BORROW PIT

GRAVEL PIT

Honey Creek

Second Sister Lake

Third Sister Lake

20 21 22 23 24 25 26 27 28 29 32 33 34 35 36

1 Mile 5000 Feet

Scale 1:20000

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN NO. 27

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 175 000 FEET

R. 6 E. | R. 7 E.

(Joins sheet 20)

290 000 FEET

T. 2 S.

(Joins sheet 26)

(Joins sheet 34)

(Joins sheet 28)

2 195 000 FEET

280 000 FEET

ANN ARBOR (county seat)

HURON RIVER

PENN CENTRAL

GRAVEL PIT

Scale · 1:20000

1 Mile

5000 Feet

N

R. 7 E.

T. 2 S.

1 Mile

5000 Feet

Scale 1:20000

1 0 1/4 0 1/2 1000 3/4 2000 1 3000 1 1/4 4000 1 1/2 5000

2 220 000 FEET

290 000 FEET

280 000 FEET

2 200 000 FEET

(Joins sheet 21)

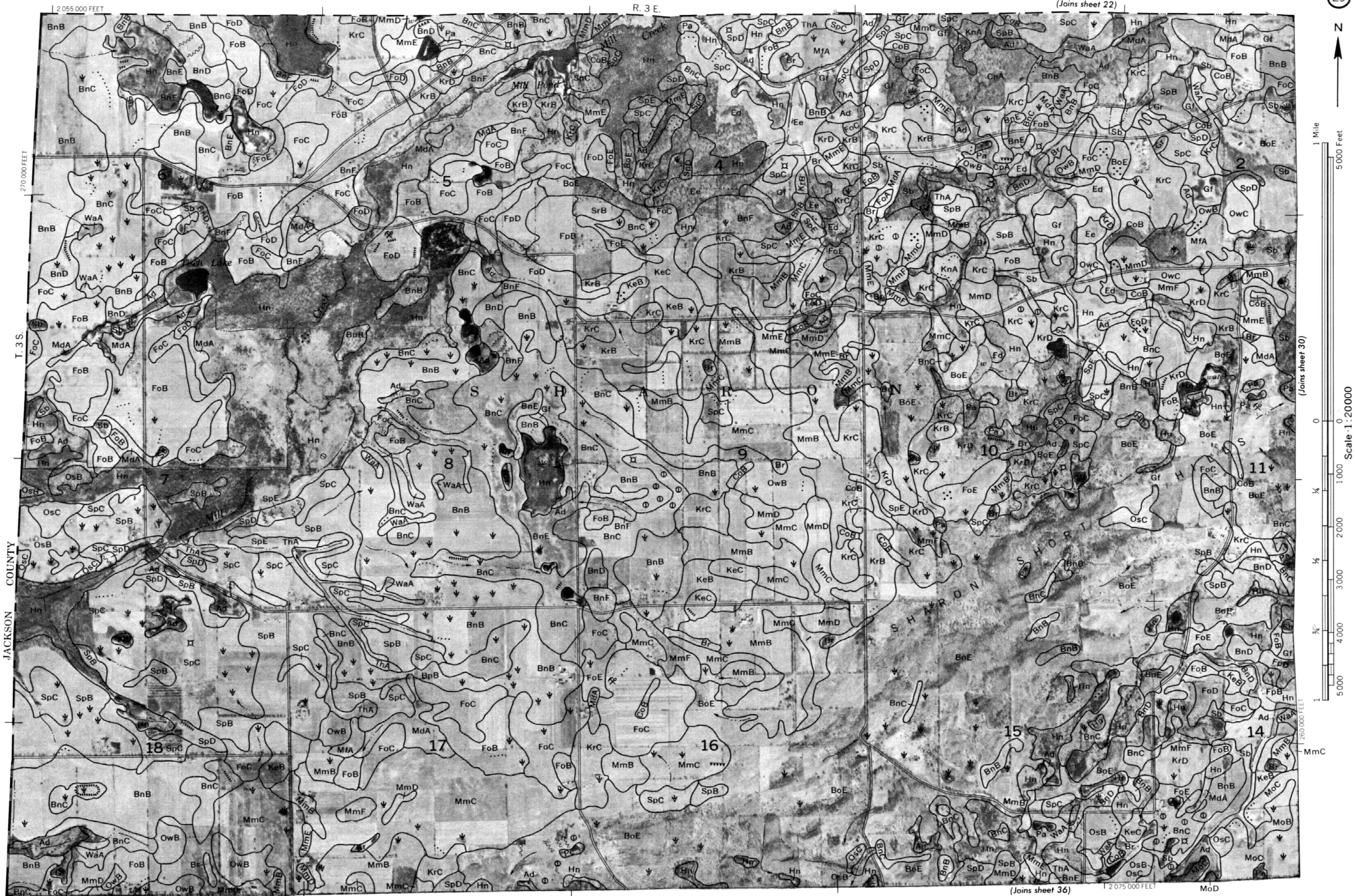
(Joins sheet 27)

(Joins sheet 35)

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies

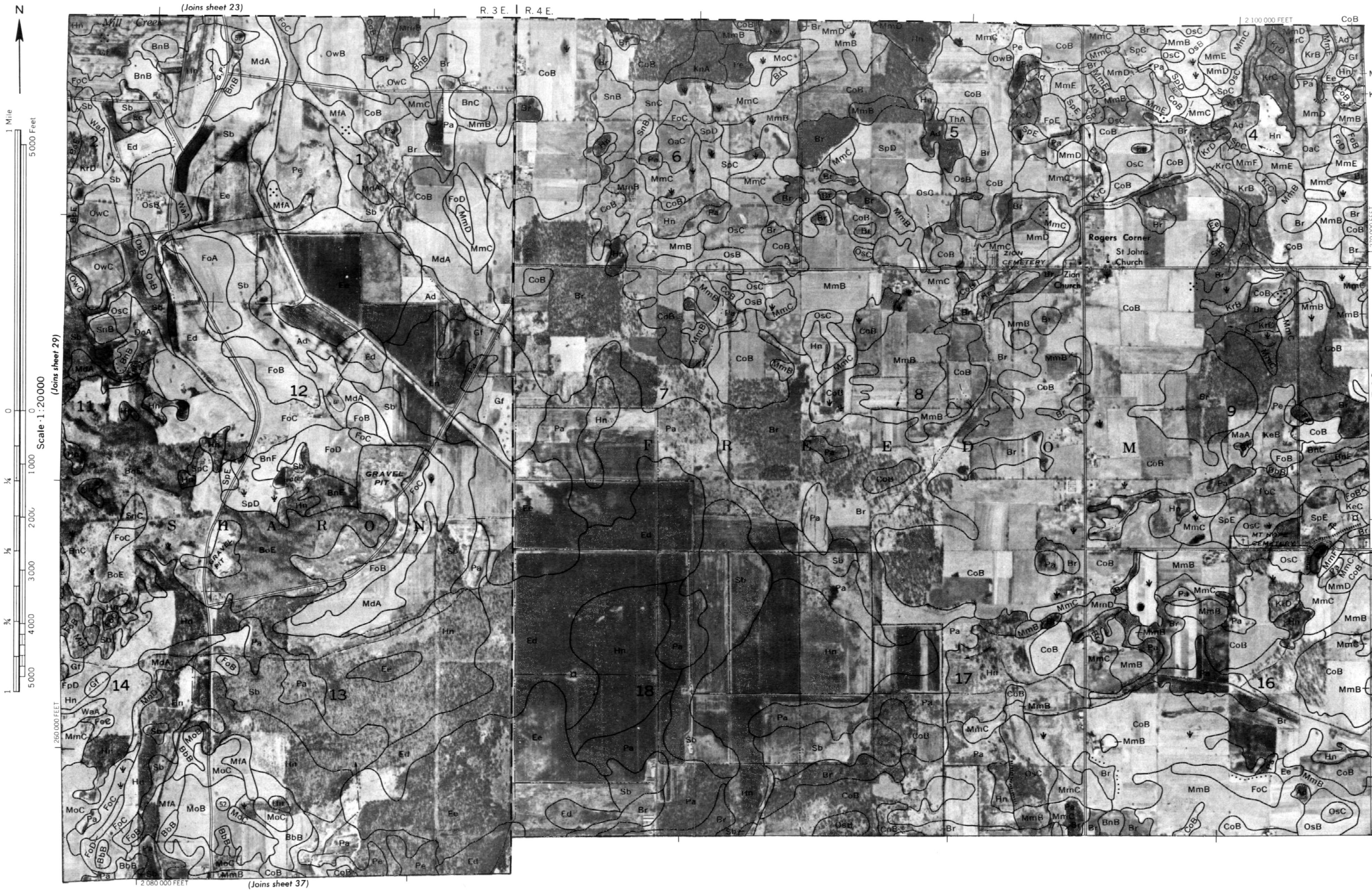
Coordinate grid ticks and land division corners, if shown, are approximately positioned

WASHTENAW COUNTY, MICHIGAN NO. 28

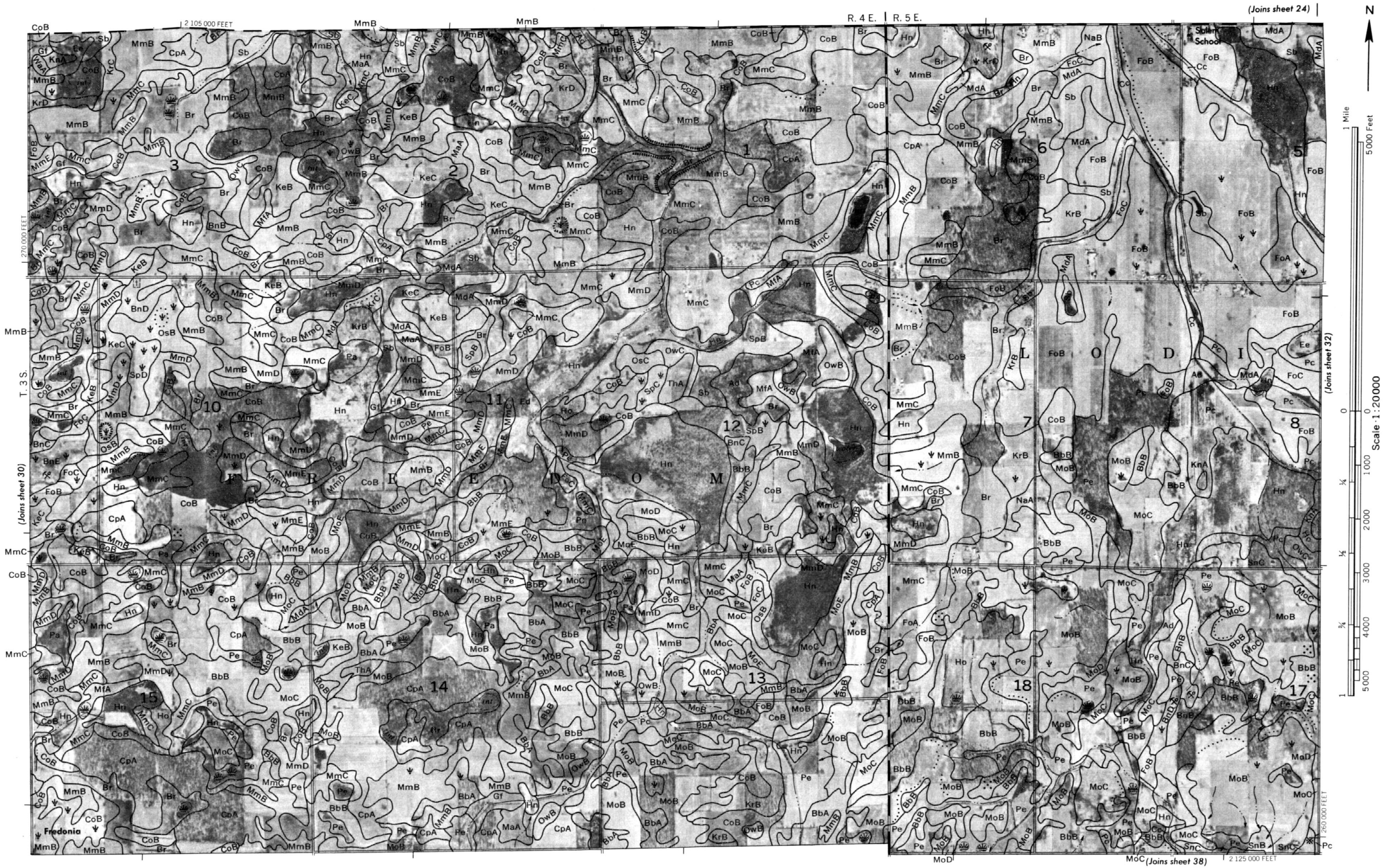


WASHTENAW COUNTY, MICHIGAN NO. 29

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



WASHTENAW COUNTY, MICHIGAN NO. 31

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(32)

N

(Joins sheet 25)

R. 5 E.

2 145 000 FEET

275 000 FEET

(Joins sheet 31)

(Joins sheet 33)

T. 3 S.

2 260 000 FEET

2 130 000 FEET

(Joins sheet 39)

1 Mile

5000 Feet

0

0

Scale 1:20000

1 000

¼

2 000

½

3 000

¾

4 000

1

5 000

This map is compiled on 1959 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN NO. 32

WASHTENAW COUNTY, MICHIGAN NO. 33

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 150 000 FEET

275 000 FEET

R. 6 E.

T. 3 S.

(Joins sheet 26)

(Joins sheet 32)

(Joins sheet 34)

(Joins sheet 40)

2 170 000 FEET

265 000 FEET

ANN ARBOR
(county seat)

ANN ARBOR
MUNICIPAL AIRPORT

GRAVEL PIT

BORROW PIT

PENN CENTRAL

ANN ARBOR

Swift Drain

N

1 Mile

5000 Feet

Scale 1:20000

(34)

N

R. 6 E. | R. 7 E.

(Joins sheet 27)

2 195 000 FEET

275 000 FEET

(Joins sheet 33)

265 000 FEET

2 175 000 FEET

(Joins sheet 41)

(Joins sheet 35)

T. 3 S.

1 Mile

5 000 Feet

Scale 1:20000

ANN ARBOR

YPSILANTI

HURON RIVER

FORD LAKE

PENN CENTRAL

ST JOHNS CEMETERY

HIGHLAND CEMETERY

691

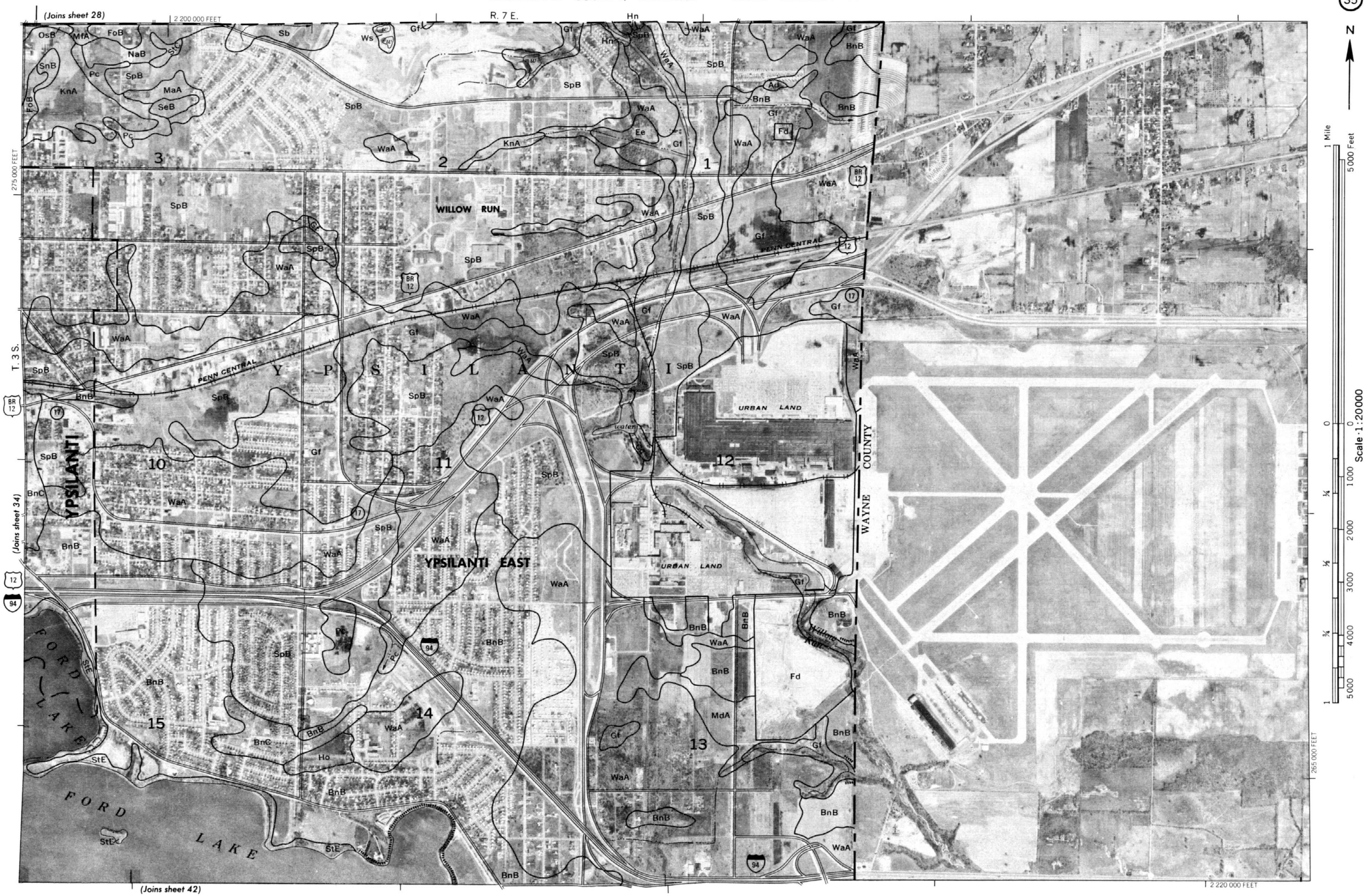
690

680

681

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN NO. 34



WASHTENAW COUNTY, MICHIGAN NO. 35

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

(Joins sheet 29)

R. 3 E.

2 075 000 FEET

255 000 FEET

T. 3 S.

COUNTY

JACKSON

Sharon Hollow

RAISIN

RAISIN

2 055 000 FEET

(Joins sheet 43)

(Joins sheet 44)

(Joins sheet 37)

1 Mile

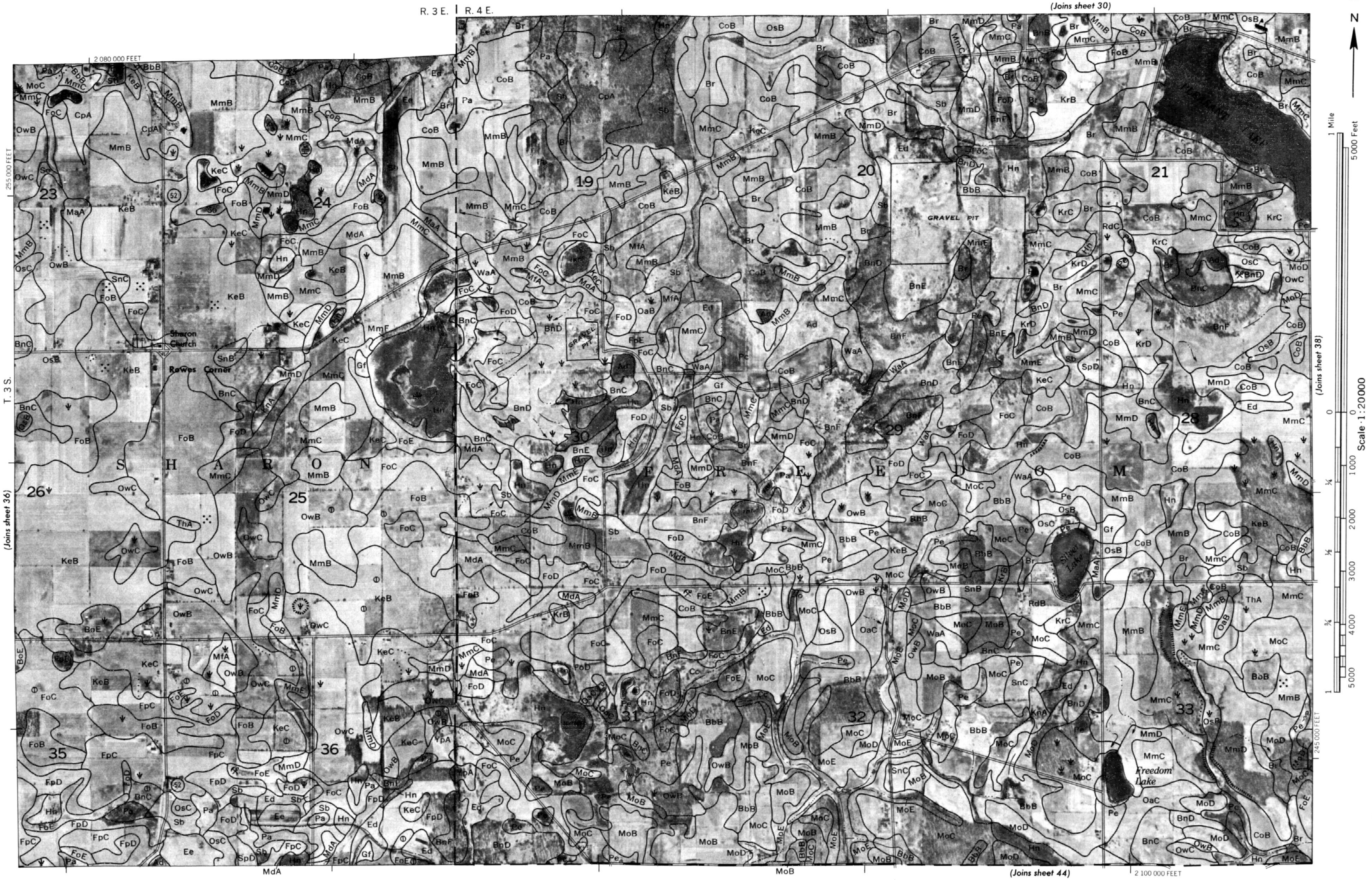
5000 Feet

Scale 1:20000

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN NO. 36



WASHTENAW COUNTY, MICHIGAN NO. 37

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN — SHEET NUMBER 38

38

N

(Joins sheet 31)

R. 4 E. | R. 5 E.

2 125 000 FEET

T. 3 S.

(Joins sheet 39)

(Joins sheet 37)

Scale 1 : 20000

1 Mile

5000 Feet

245 000 FEET

2 105 000 FEET

(Joins sheet 45)

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies

Coordinate grid ticks and land division corners, if shown, are approximately positioned

WASHTENAW COUNTY, MICHIGAN NO. 38

WASHTENAW COUNTY, MICHIGAN NO. 39

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 130 000 FEET

R. 5 E.

So (Joins sheet 32)

T. 3 S.

255 000 FEET

(Joins sheet 38)

(Joins sheet 40)

245 000 FEET

(Joins sheet 46)

2 150 000 FEET

SALINE

Arnold Lake

Saline River

Miller

PENN CENTRAL

GRAVEL PIT

N

1 Mile

5 000 Feet

Scale 1:20000

(40)

N

(Joins sheet 33)

(Joins sheet 39)

R. 6 E.

T. 3 S.

2 170 000 FEET

260 000 FEET

(Joins sheet 41)

245 000 FEET

2 155 000 FEET

(Joins sheet 47)

12

1 Mile

5000 Feet

Scale 1 : 20000

0 0 ¼ 1000 ½ 2000 ¾ 4000 1 5000

Pittsfield

SALINE

Wood Outlet Drain

Warner Drain

Koch Drain

Pittsfields Drain

ANN ARBOR RR

PENN CENTRAL

GRAVEL PIT

This map is compiled on 1959 aerial photography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

WASHTENAW COUNTY, MICHIGAN NO. 40

R. 6 E. R. 7 E.

2 175 000 FEET

(Joins sheet 34)

260 000 FEET

T. 3 S.

BbB

(Joins sheet 40)

(Joins sheet 42)

250 000 FEET

2 195 000 FEET

OsC

(Joins sheet 48)

N

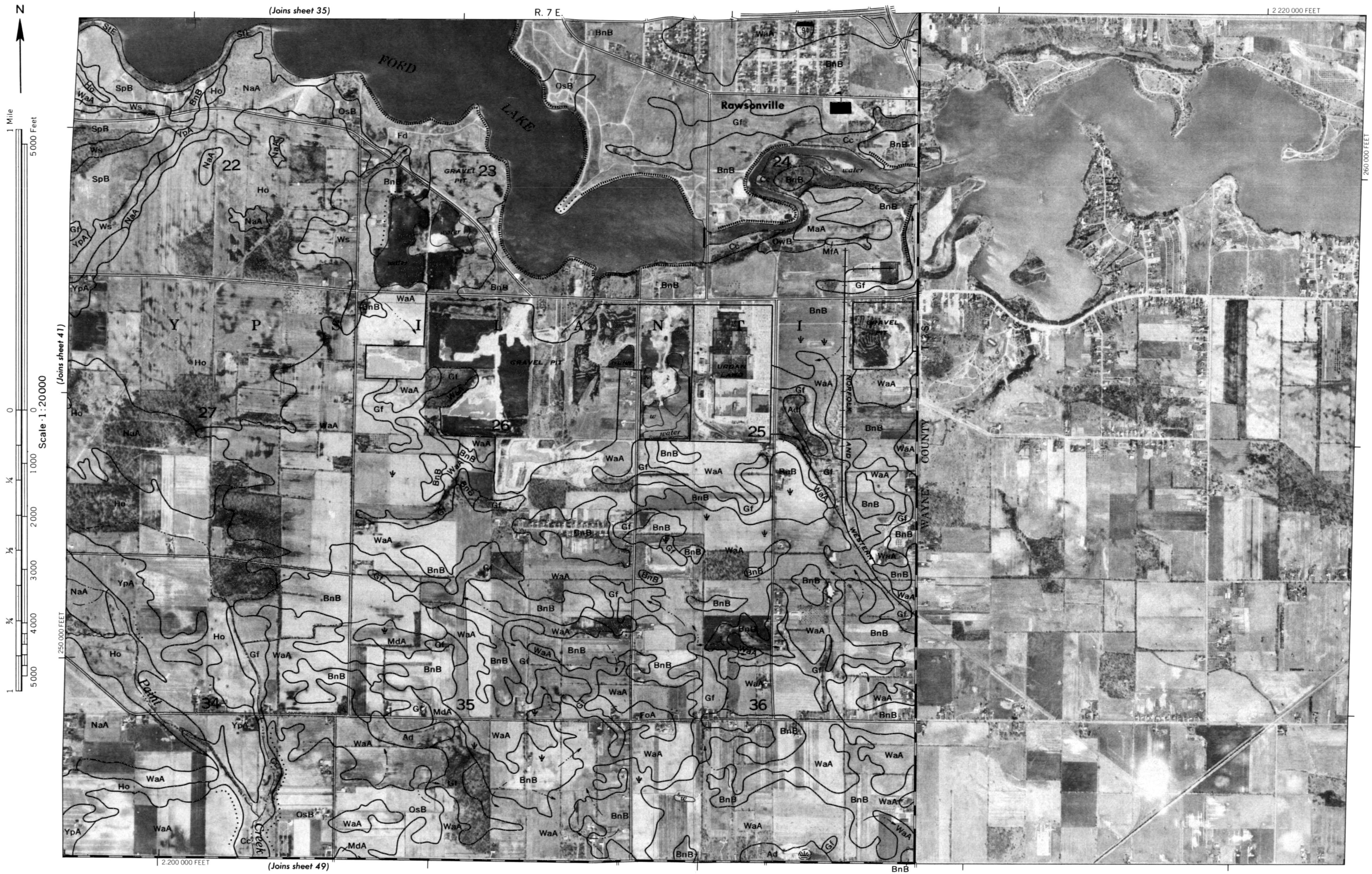
1 Mile

5000 Feet

Scale 1:20000

WASHTENAW COUNTY, MICHIGAN NO. 41

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN NO. 43

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 3 E.

T. 4 S.

2 055 000 FEET

240 000 FEET

(Joins sheet 36)

(52)

JACKSON COUNTY

MANCHESTER TOWNSHIP

Thorn Lake

Watkins Lake

Manchester

GRAVEL PIT

G.P.

(51) (Joins sheet 44)

225 000 FEET

2 075 000 FEET

(Joins sheet 50)

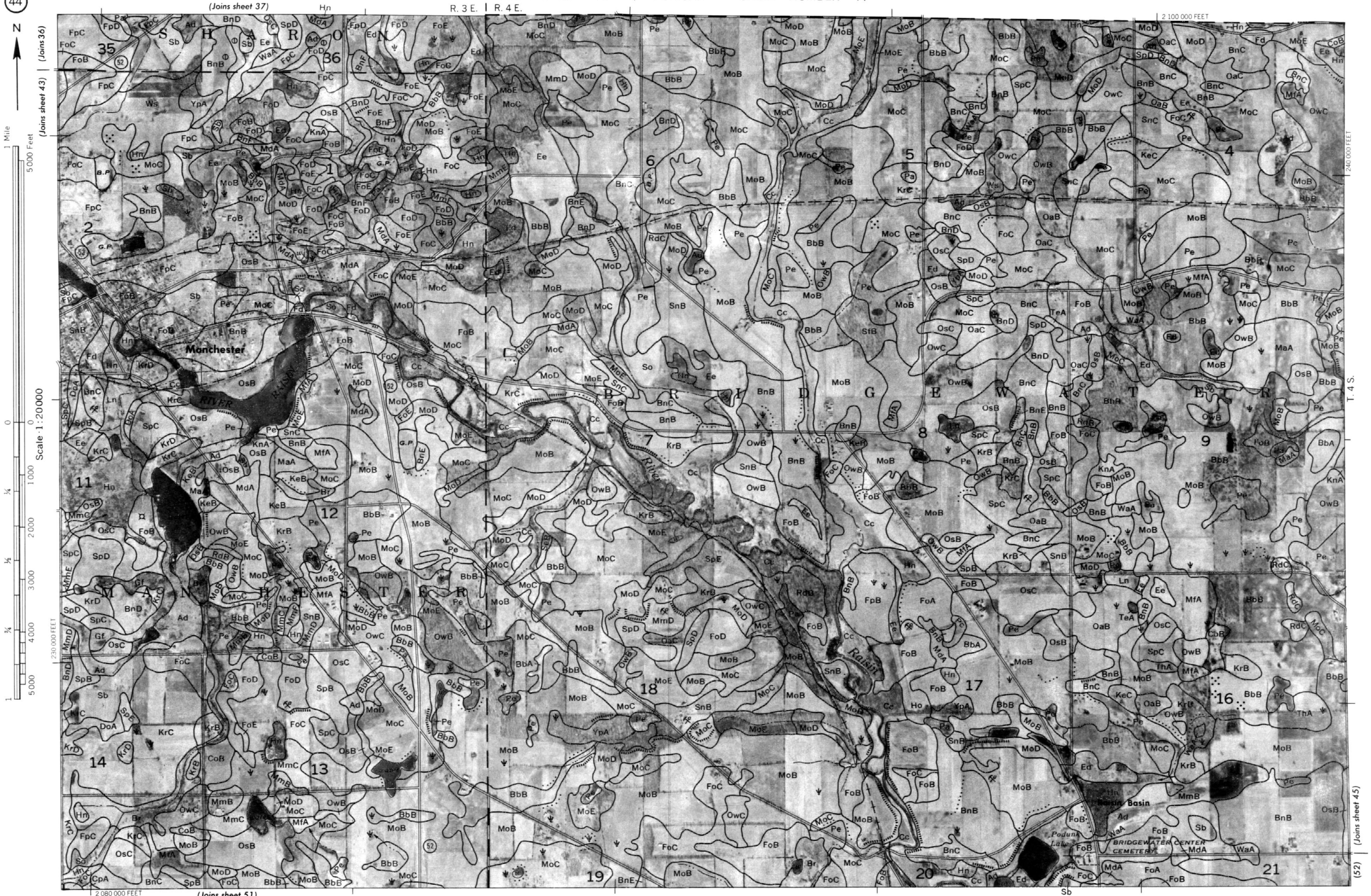
N

1 Mile

5,000 Feet

Scale 1:20000

WASHTENAW COUNTY, MICHIGAN — SHEET NUMBER 44



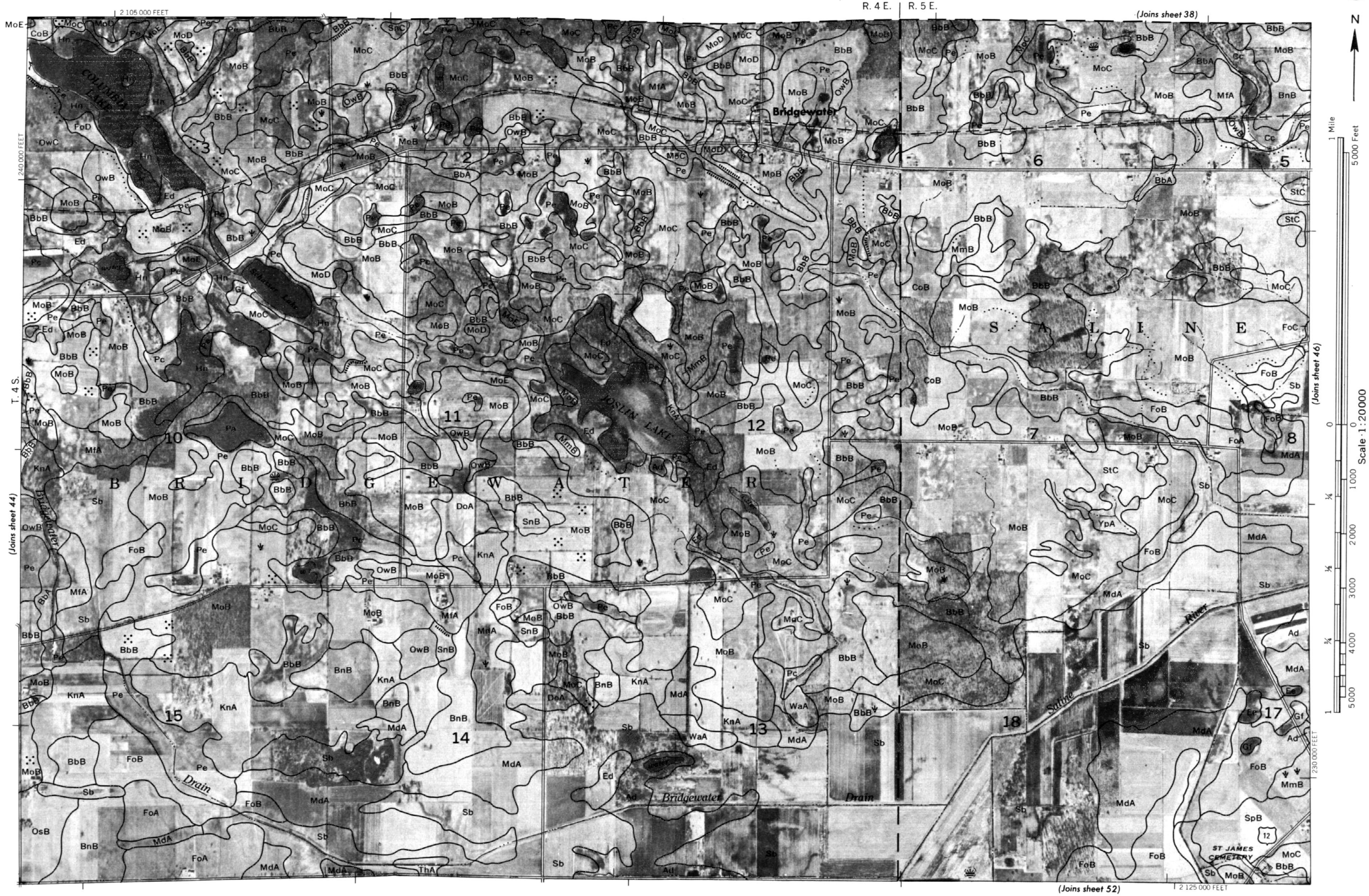
This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

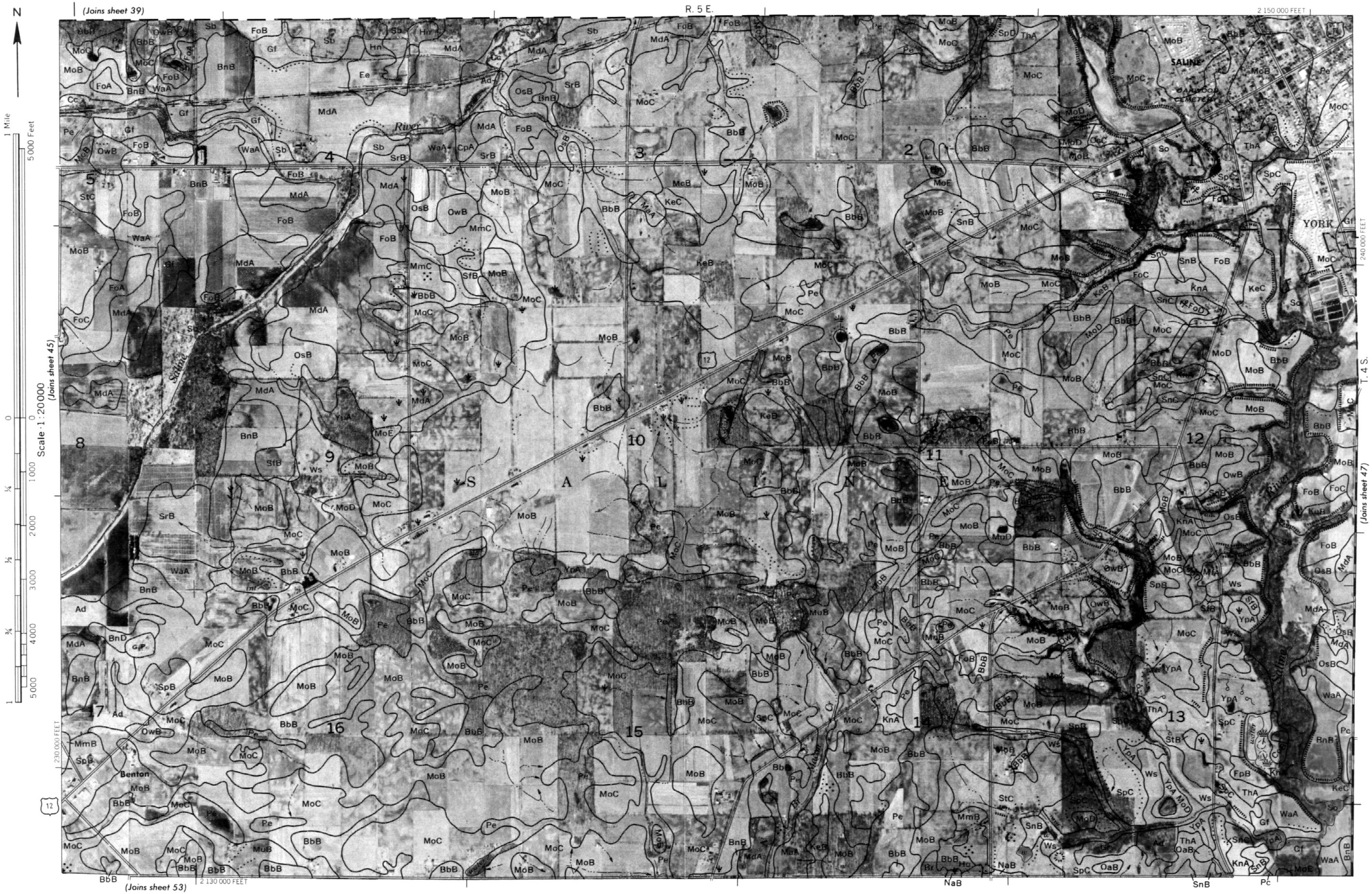
Coordinate grid ticks and land division corners, if shown, are approximately positioned

WASHTENAW COUNTY, MICHIGAN NO. 44

WASHTENAW COUNTY, MICHIGAN NO. 45

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

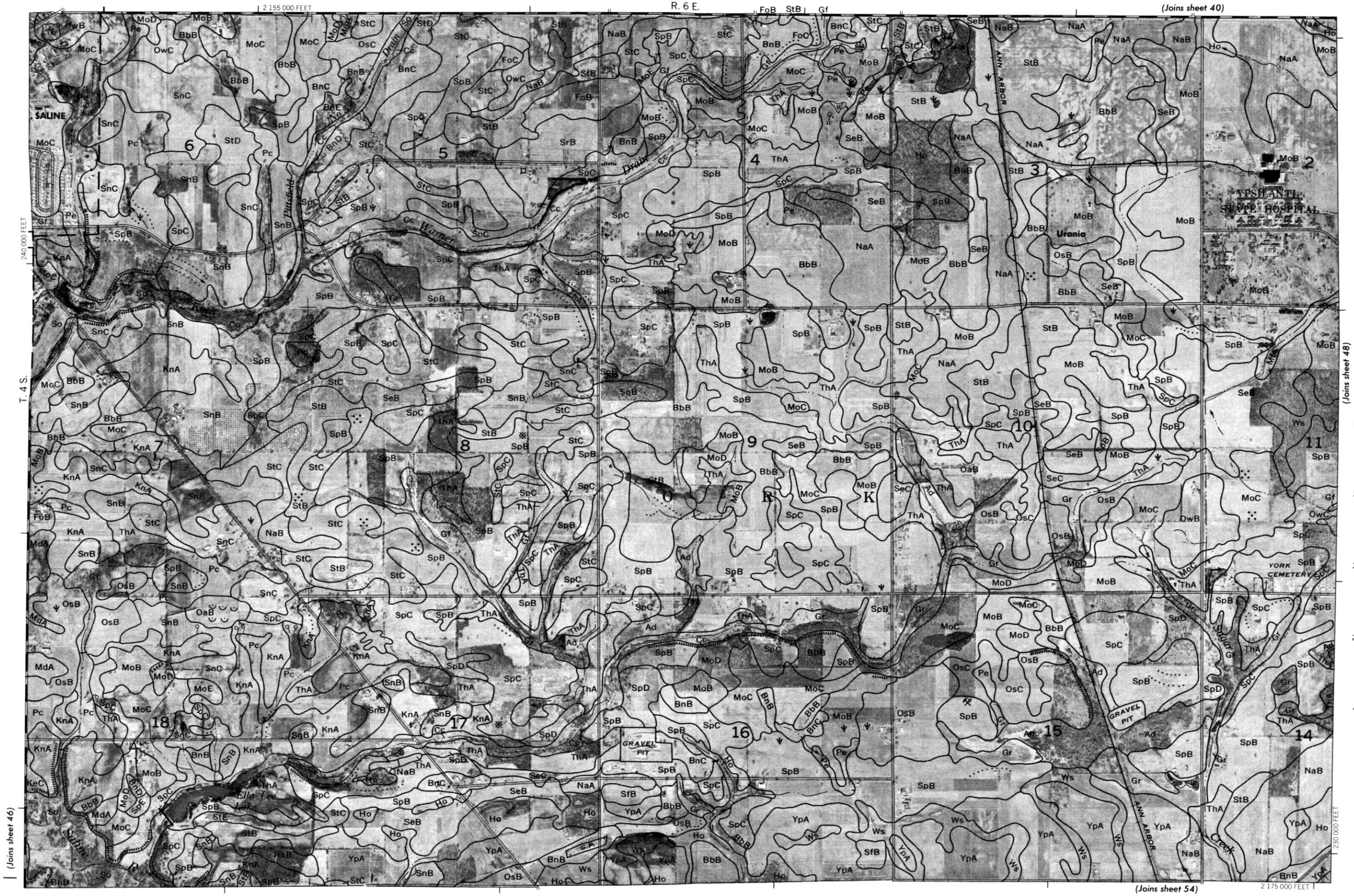




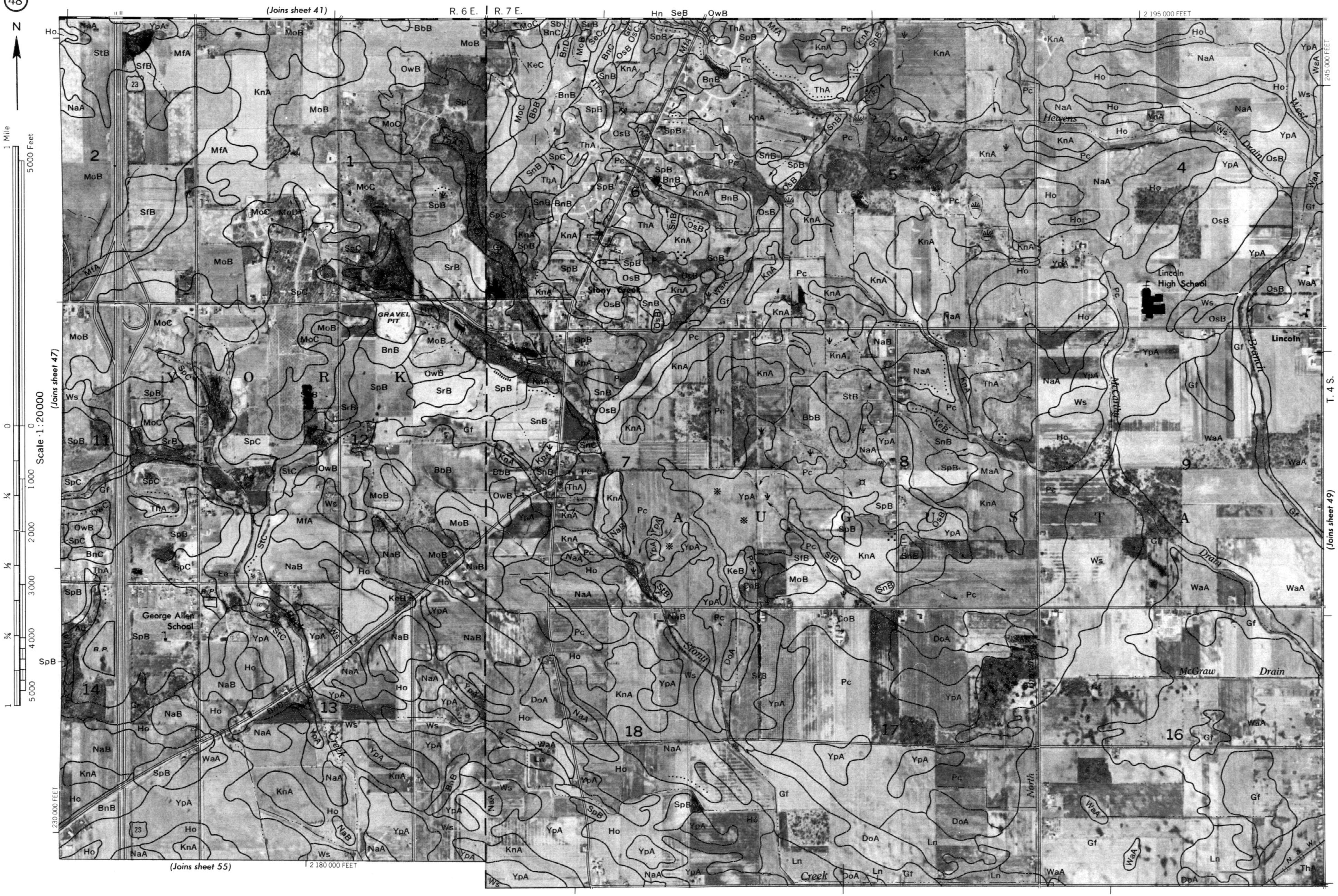
This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN NO. 47

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

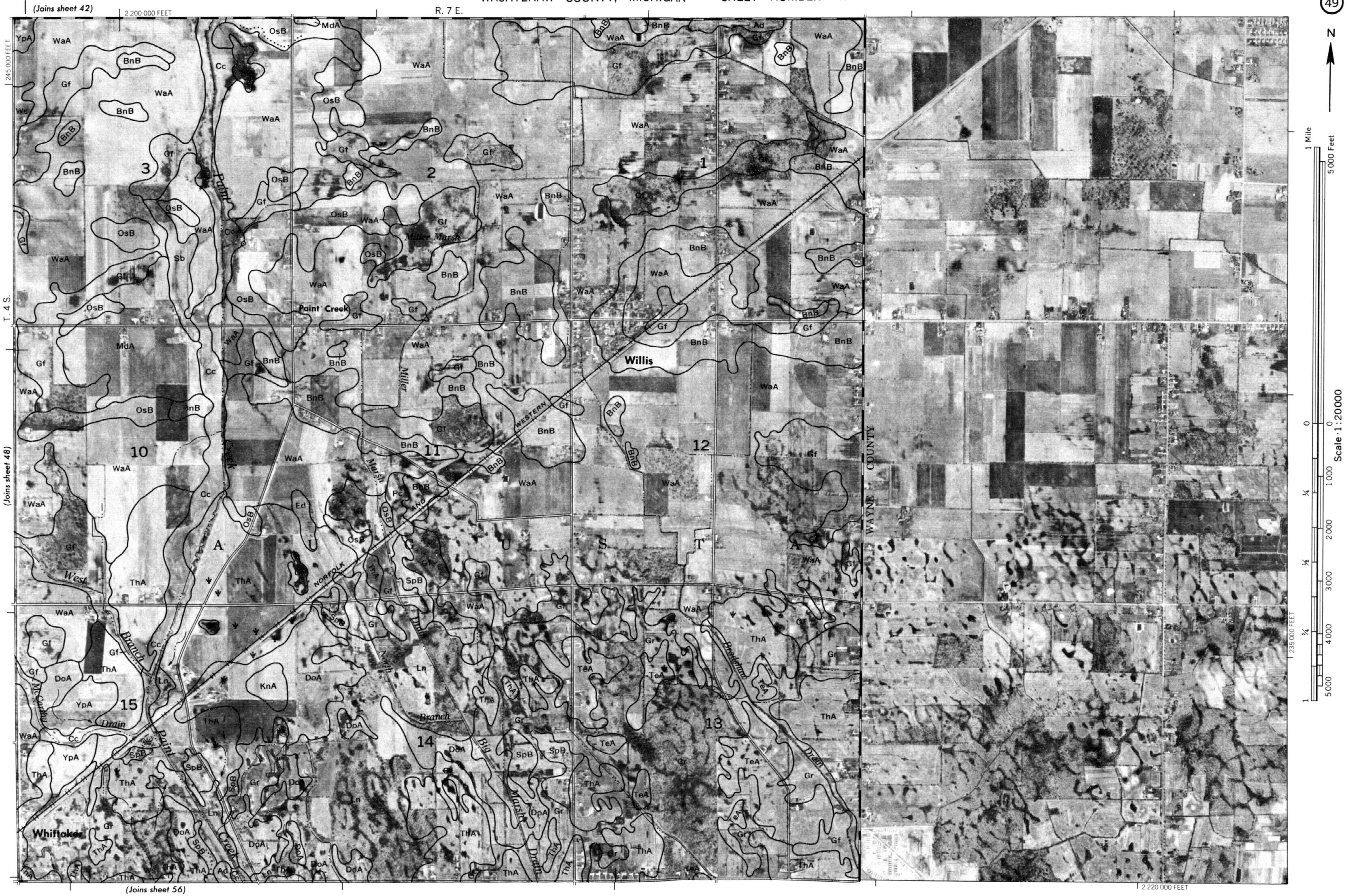


WASHTENAW COUNTY, MICHIGAN — SHEET NUMBER 48



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN NO. 48



WASHTENAW COUNTY, MICHIGAN NO. 49

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

(Joins sheet 43)

R. 3 E.

JACKSON COUNTY

Scale 1:20000

1 Mile
5000 Feet
0 1000 2000 3000 4000 5000

2 075 000 FEET

220 000 FEET

210 000 FEET

2 055 000 FEET

T. 4 S.

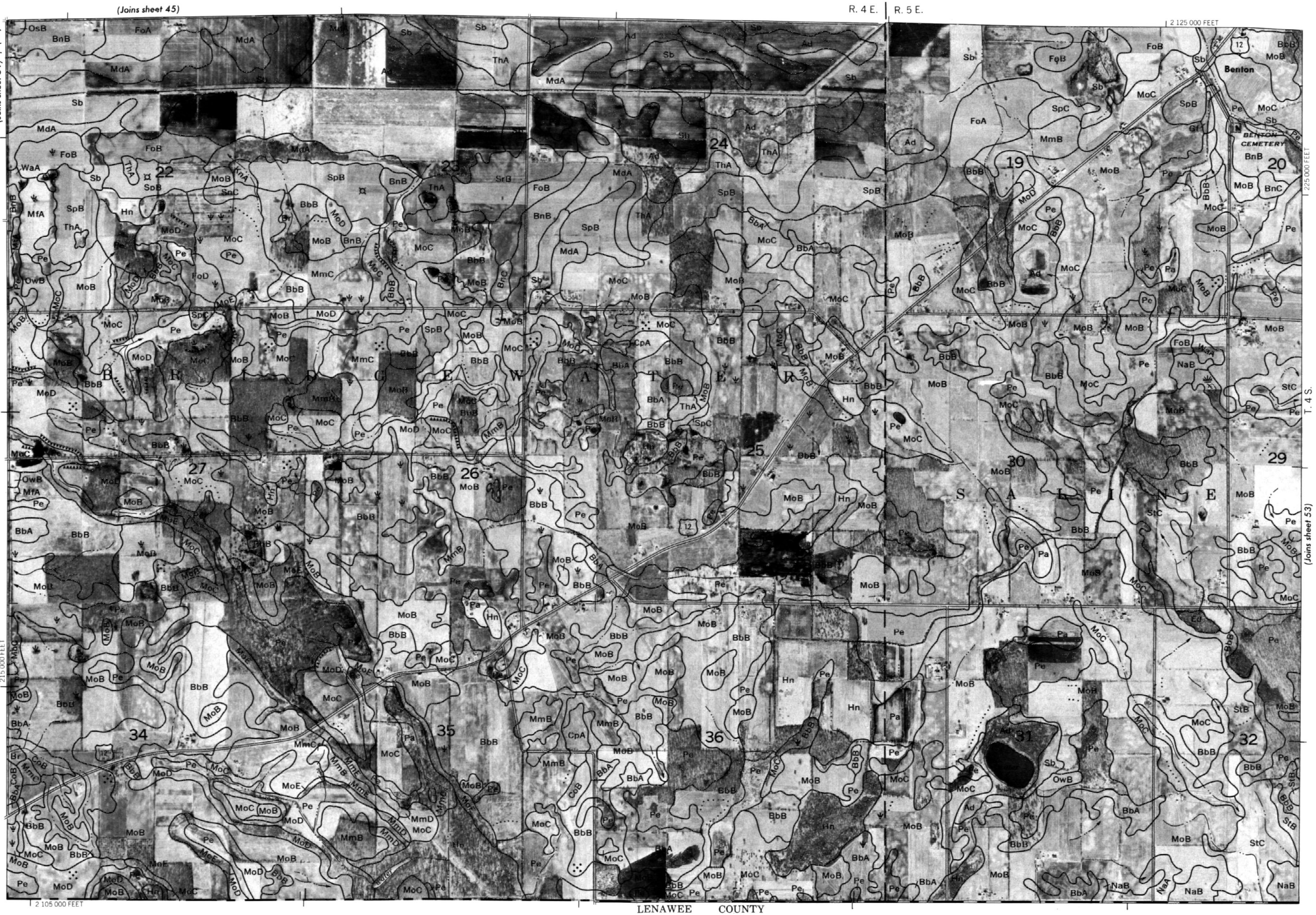
(Joins sheet 51)

LENAWEE COUNTY

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN. — SHEET NUMBER 52



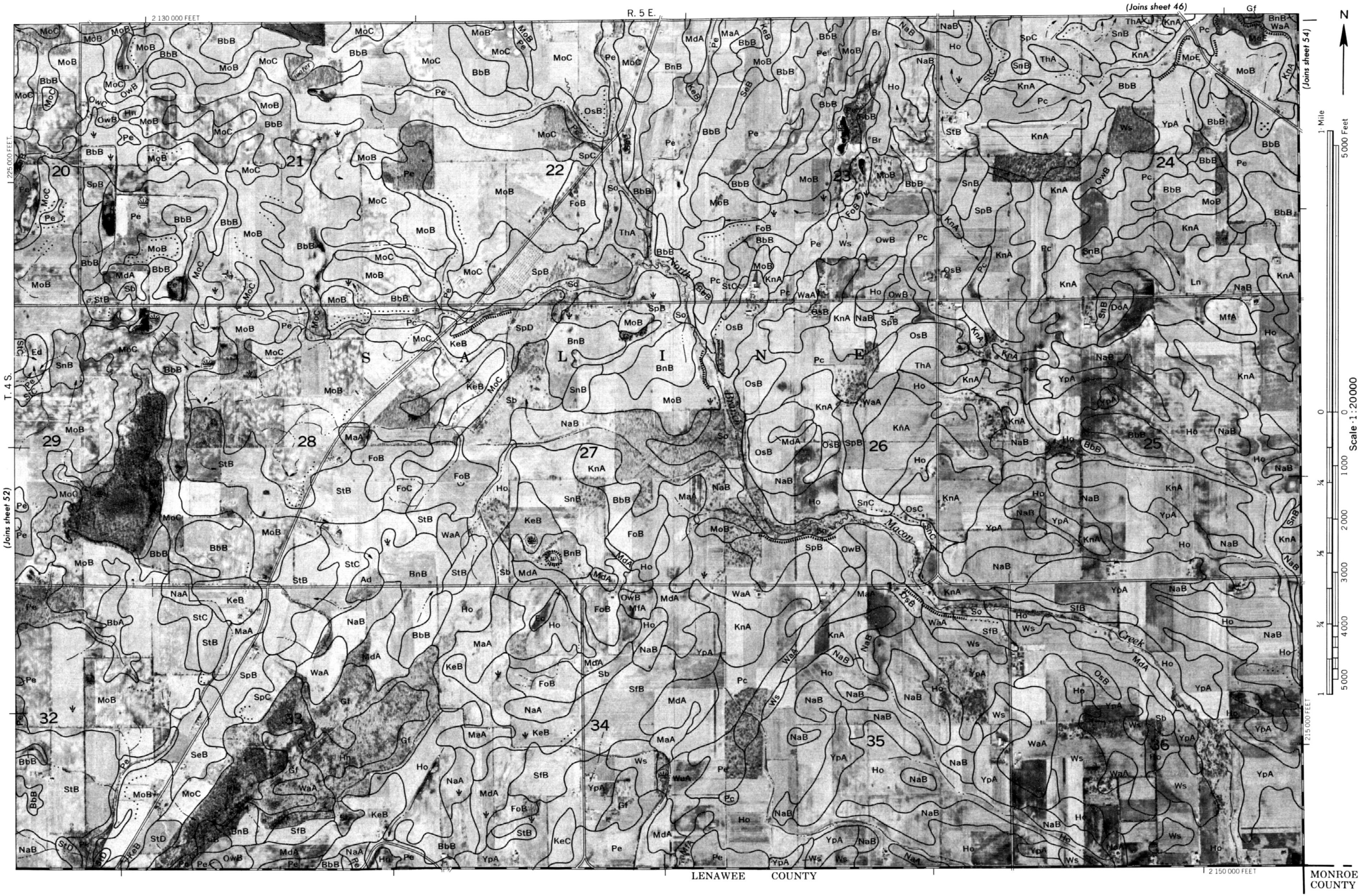
N

Scale 1:20000

1 Mile
5000 Feet
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN NO. 52



WASHTENAW COUNTY, MICHIGAN NO. 53

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

(Joins sheet 47)

R. 6 E.

2 175 000 FEET

T. 4 S.

(Joins sheet 55)

225 000 FEET

215 000 FEET

2 155 000 FEET

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 53)

Saline River

Mooreville

McIntyre

Milan

Sugar Creek

Drain

GRAVEL PIT

MARBLE PARK CEMETERY

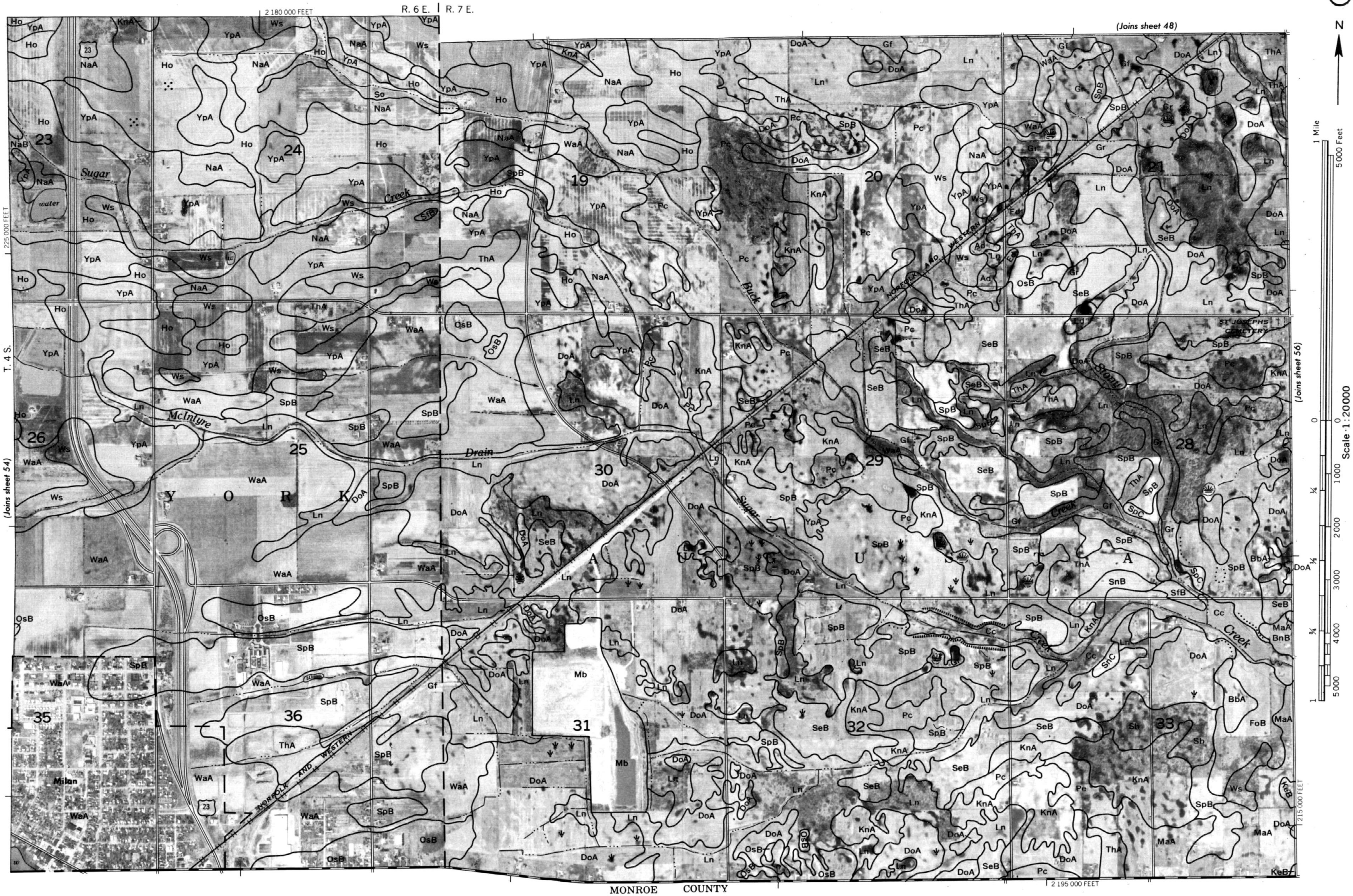
ANN ARBOR

LENAWEE COUNTY

MONROE COUNTY

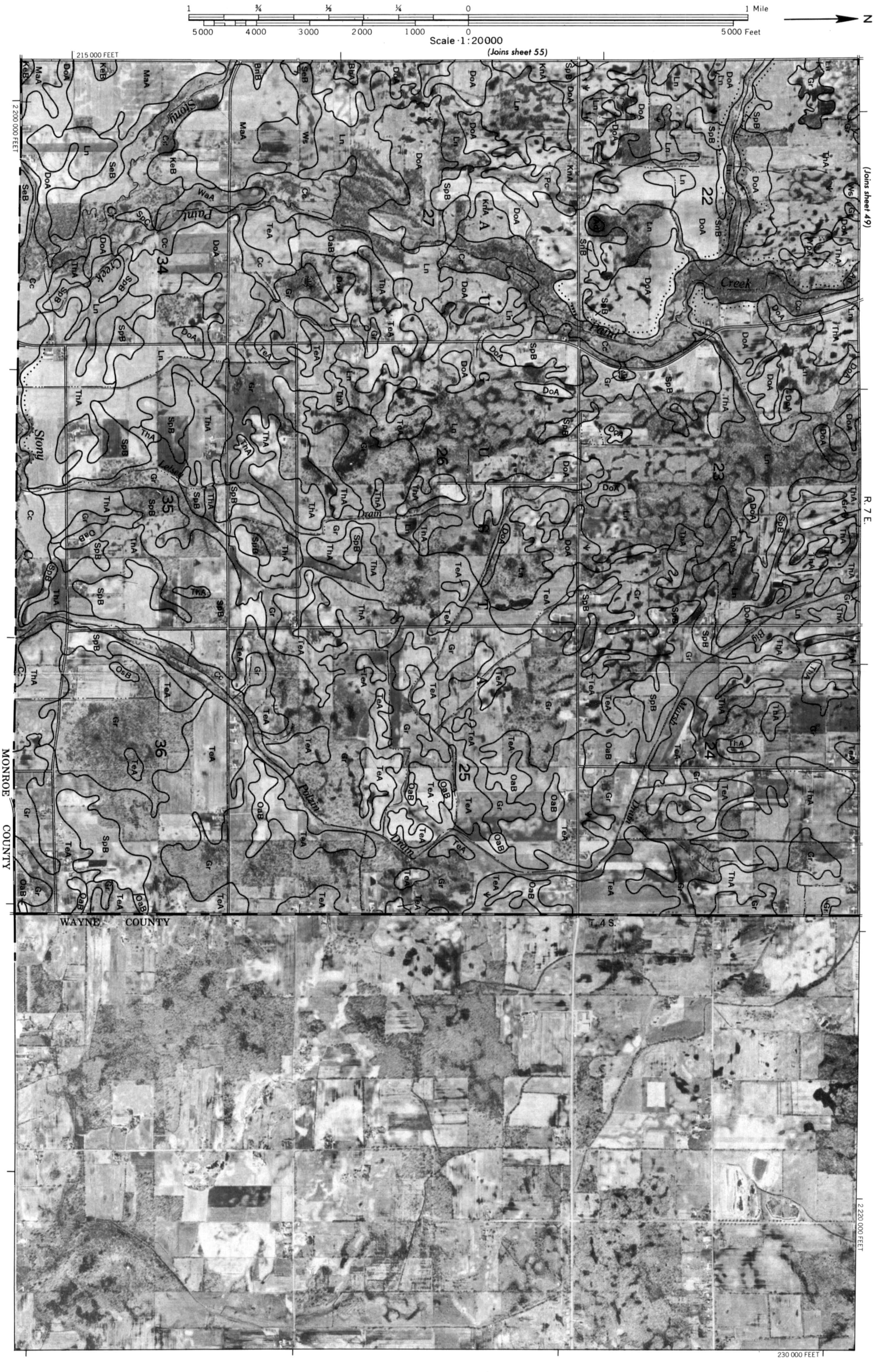
This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN NO. 54



This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHTENAW COUNTY, MICHIGAN NO. 55



WASHTENAW COUNTY, MICHIGAN NO. 56

This map is compiled on 1969 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.